drawing is furnished on white paper, from which to photograph.

hoto-Engraving: — producing at half cost of wood engraving an ordinary electrotype from any line drawing.

lbertype: — the most satisfactory of all the processes for obtaining photographic fac-similies of any class of originals producing the effect either of line engravings or of a photograph.

We cheerfully furnish full information and estimates to all who may need illustrations of any kind.

The Forbes Company. Boston.

SCIENCE

AN ILLUSTRATED JOURNAL

PUBLISHED WEEKLY

VOLUME I

FEBRUARY—JUNE 1883

CAMBRIDGE MASS.
THE SCIENCE COMPANY
MOSES KING PUBLISHER
1883

Franklin Press:
RAND, AVERY, AND COMPANY,
BOSTON.

CONTENTS OF VOLUME I.

SPECIAL ARTICLES.

BOOK REVIEWS.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

*** *Under this heading the boldfaced numerals refer to the separate paragraphs; the others, as elsewhere, to the pages.*

LIST OF CONTRIBUTORS WHOSE NAMES APPEAR BY INITIALS IN THE WEEKLY SUMMARY.

LIST OF PERSONS WHOSE WRITINGS ARE QUOTED IN THE WEEKLY SUMMARY.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

STATE INSTITUTIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

PROSPECTUS OF SCIENCE FOR 1883.

UNDER this title an illustrated journal will be published weekly, to which the attention of scientific men and the educated public is invited.

SCIENCE will be a strictly independent journal, devoted to the advancement of knowledge and scientific research in America, and will be technical only in so far as the subject-matter may require. On the one hand it will claim the support of scientific men as the most available channel for the early publication of condensed results of their researches, and on the other it will appeal to the intelligence of the general public by its careful exposition of scientific discovery, while both will profit by its weekly reports of scientific progress, drawn from original sources of the very latest date, and from all parts of the world.

SCIENCE will offer a ready and rapid means of intercommunication between the scattered scientific men of America, which they have never yet enjoyed, and will endeavor to become, in a high sense, the exponent of the best scientific thought of the country. By its impartial reviews of scientific literature, both native and foreign, it will be welcomed by every person of ordinary culture. Particular attention will be paid to current periodical literature and the proceedings of learned bodies, which give the latest results of scientific study; arrangements have been made for their early receipt, often in advance of ordinary publication; and the miscellaneous material so obtained will be carefully digested, and presented under specific heads. This prominent feature, which has never before been introduced in a weekly journal, will be particularly attractive to the specialist, in whatever branch, who will at once know where to look for the latest information about all the more important work in his own field of investigation.

SCIENCE purposes to furnish original articles by the most capable writers on the results of scientific research, to urge the importance of scientific education, and to illustrate the applications of scientific principles to all matters pertaining to national progress and practical affairs of every kind. The scope of SCIENCE will be as broad as its name: in every field of inquiry where the scientific method is adopted, it will hope to enter. Chronicler of the latest discoveries, but without affecting to hold a judicial position, it will indicate their relation to current thought and philosophy, as well as to the exigencies of daily life, in a fearless yet reverent spirit, — not too hasty in supporting plausible hypothesis, but ever open to the truth.

To promote one of its chief objects, and as a distinctive feature of the journal, SCIENCE will give its hearty support to those who are endeavoring

to introduce the study of the natural and physical sciences into public and private schools, by drawing attention in every possible way to the high importance of this measure, as well as by giving illustrated articles, plainly worded, prepared by skilful hands, to guide the efforts of the teachers.

Practical men will find in Science carefully written papers on the applications of the principles of mechanics and other branches of physics to all departments of industry and technology. The unprecedented recent advances in the applications of electricity demand for them a prominent place; while optics, acoustics, thermodynamics, mining, metallurgy, engineering, mechanical processes, and all forms of motive power, will receive their fair share of attention.

Science has secured in advance the good-will and active support of a large body of the most competent scientific men of the country, as will sufficiently appear upon the publication of a few numbers.

Communications will be welcomed from any quarter, and a fair price will be paid for such as are accepted; rejected manuscripts will be returned to the authors, provided the requisite amount of postage accompanies the manuscripts.

Secretaries of scientific societies all over the world, and authors and publishers of works on scientific subjects, are invited to send their publications for notice to the editor as soon as possible after issue.

Science begins on Feb. 9, 1883; each issue will contain at least twenty-six larg[illegible]o pages of reading matter [with illustrations], making for the year two [illegible]umes with a total of nearly 1,500 pages, apart from all advertisements, and carefully indexed. The subscription price will be $5.00 a year, postpaid in the United States and Canada; for other countries, $6.00 a year, postage prepaid. Single numbers, 15 cents.

THE SCIENCE COMPANY,

MOSES KING, *Publisher.*

*** *Books and pamphlets for review, articles for* Science, *and all editorial correspondence relating thereto, should invariably be addressed:* Editor of Science, *Cambridge, Mass.*

*** *Advertisements, subscriptions, and all kinds of business correspondence, should be addressed:* Moses King, *Publisher, Cambridge, Mass.*

THE SCIENCE COMPANY.

Organized, 1883, under the laws of the Commonwealth of Massachusetts.

President: DANIEL C. GILMAN, *Baltimore, Md.* Vice-President: ALEXANDER GRAHAM BELL, *Washington, D.C.*

Directors: Daniel C. Gilman of Baltimore; Alexander Graham Bell of Washington; Gardiner G. Hubbard of Washington; Othniel C. Marsh of New Haven. Treasurer: Samuel H. Scudder of Cambridge.

Offices of the Company, the Publisher, and the Editor: Cambridge, Mass.

SCIENCE.

AN ILLUSTRATED JOURNAL PUBLISHED WEEKLY.

Vérité sans peur.

CAMBRIDGE, MASS.: MOSES KING, PUBLISHER.

FRIDAY,, FEBRUARY 9, 1883.

THE FUTURE OF AMERICAN SCIENCE.

THE progress of science in any age is determined largely by the circumstances of its environment. The soil in which it is rooted, the atmosphere from which it draws the materials of its life, and the stimulus of light and heat which it receives, all have a strong determining influence upon its growth. Nowhere, probably, has this influence of the surroundings been more potent than in our own land. The intense activity of our people, the high intellectual, commercial, and social pressure under which they live, their enthusiastic interest in scientific knowledge and the generous liberality with which they foster it, — all these agencies have had a powerful influence in creating the position which American science assumes to-day. We may not, indeed, boast of a scientific record as full and complete as that of other countries; but we may and should take an honest pride in the achievements in pure science which we have already actually accomplished. The names of Agassiz and of Peirce, of Bache, Henry, and Draper, of Hare and Silliman, of Bond, Watson, and Chauvenet, of Rittenhouse and Saxton, of Rogers, Hitchcock, and Cleaveland, are worthy to be enrolled high up in the temple of scientific fame. The work done by these men in the direction of original research will ever stand the test of time, and will always keep their memories green.

The leading feature of American science, however, and that which most distinctively characterizes it, is its utilitarianism. True, there are in our country able investigators working in scientific fields which do not offer the promise of material reward; but notwithstanding this, it remains still true that those sciences whose principles are capable of useful application are the most zealously cultivated among us, and attract the largest number of students. Nor is this to be at all regretted. Research is none the less genuine, investigation none the less worthy, because the truth it discovers is utilizable for the benefit of mankind. Granting, even, that the discovery of truth for its own sake is a nobler pursuit, because a less purely selfish one; does it become any the less noble when it is ascertained that the truth thus discovered is capable of important applications which increase tenfold the happiness of human life? It may readily be conceded that the man who discovers nothing himself, but only applies to useful purposes the principles which others have discovered, stands upon a lower plane than the investigator. But when the investigator becomes himself the utilizer; when the same mind that made the discovery contrives also the machine by which it is applied to useful purposes, — the combined achievement must be ranked as superior to either of its separate results.

The inventive genius of this country is preeminent. We reap the benefits of it on every side. Our houses are more comfortable, our railways more safe, our fabrics cheaper, and our education more thorough, because of useful inventions. Becoming restive at the slow progress of discovery, the inventor has himself assumed the *rôle* of investigator; and the results of his researches appear in the records of the patent-office. In the olden times the investigator was content to make his discoveries, and to publish them, consecrating to science the knowledge thus obtained. His more modern representative carefully treasures what he has discovered, until he has exhausted its practical applications. In consequence, the

discoveries upon which many of the most important scientific inventions of the day rest, will be searched for in vain in scientific literature. The telegraph, the telephone, and the electric light are inventions which illustrate the fact now stated, in an eminent degree.

Another direction in which applied science has been developed in this country is found in the work done by the various government organizations. Is the weather-probability an important factor in the citizens' welfare? Immediately the signal service of the army is developed into a complete meteorological organization to collect data, and deduce forecasts. Is navigation to be made more safe, and internal boundaries more accurate? The coast and geodetic survey is created to carry on the most refined investigations upon standards of measure, and the various methods of applying them. Is the fishery question an important one to our commercial interests? A fish commission is organized, and under its direction the most elaborate investigations in vertebrate and invertebrate zoölogy are undertaken. Are the mineral lands of the government to be reported on? Geological surveys are commissioned to explore the public domain, and are clothed with ample power to make their work elaborate and exhaustive, and to embody their results in extended reports, not alone on the economic side, but including all the collateral branches of science. Is a knowledge of the properties of iron and steel of essential value in constructive engineering? Forthwith a special commission appears, charged with authority to execute the most refined chemical analyses and the most delicate physical tests upon these metals. Is there danger to agricultural interests from the depredation of insects? An entomological commission is appointed by Congress, with instructions to exhaust the resources of science for the protection of the crops. Moreover, besides the work done in this way, special investigations are always in progress under the direction of the departments; more especially those of war, of the navy, of the treasury, and of the interior; the services of the engineer-corps, in river and harbor improvements, for example, it is not easy to overestimate. In the end, it is true, these investigations have a practical object; but to attain this, in many cases, theoretical results are reached which are of the highest value to pure science.

It is no wonder, then, that, in the midst of such kindly appreciation by the intelligent and educated masses of our people, — an appreciation manifested alike by personal munificence and by governmental appropriation, — all the sciences, but especially those which reward appreciation by practical benefits, should have attained their present satisfactory development. Who can say to how large an extent the eminent position of practical astronomy in America is due to the unrivalled telescopes of Alvan Clark? The wonderful microscopic photographs of Woodward have been made possible only by the perfection to which Tolles has brought his object-glasses. The bolometer of Langley has given us new conceptions of sunlight; and the exquisite gratings of Rowland promise to do still greater things for us, in the same direction. In the experimental sciences especially, their unexampled advance is a continual testimony to the abundant return which practice has made for the benefits it has received from theory.

While the scientific cynic may condemn the utilitarianism of our age, the more liberal man rejoices in it, since science is thereby the more advanced. He is thankful that the people view these scientific questions with the broadest liberalism; that they are not disposed to confine scientific inquiry to those investigations alone whose results are practical, but pour out their substance freely in aid of scientific work in all directions, theoretical as well as practical, pure as well as applied. This generous disposition toward scientific research, so characteristic of this country, has called forth unreserved commendation in Europe. The munificence of the gifts which have been made to science, both public and private, the liberality with which research has been endowed in America, have been the astonishment of

men of science in other countries. Such is the environment in which American science has been developed; such the favoring soil, atmosphere, and warmth with which it has thus far accomplished its growth.

Under such conditions, it is not difficult to foresee a brilliant future for American science. Scientific evolution, like the evolution of a species, requires complete conformity to the conditions of existence. The science of to-day is in thorough accord with the spirit of the American people. They are proud of every achievement it makes, and are satisfied with the returns it is giving them for their investments. To continue this *entente cordiale*, should be the object of every scientific worker. He may the more readily concede some practical return for the facilities for investigation which the people have furnished; since the march of discovery is not in the least hindered, but rather promoted, by the practical application of the new truth it develops. His attitude toward invention should be appreciative and cordial. He should cast aside all prejudice against the man of patents and practical devices, and should stand ready to welcome the investigator in whatever garb he appears.

But more than this. Science must be true to itself as well as in accord with its surroundings. It must maintain ever the highest tone and the most impartial accuracy. It must covet the scrutiny of every eye, and must be generous ever in the acknowledgment of its shortcomings. Higher than all, it must be devoted to the truth. It must cheerfully undertake the severest labor to secure it, and must deem no sacrifice too great in order to preserve it. It must have an unlimited capacity for work, and an unlimited enthusiasm in it, while at the same time a proper reserve in affirming the results of it. While striving itself for the highest attainable accuracy, it must be catholic and liberal toward others. It must not magnify differences, nor impute motives. It must be ready to adjust, with the utmost patience, conclusions which are apparently discordant. It must treat all questions with fairness and candor. When it ventures nearest the boundaries of knowledge, it should assert itself cautiously. In its relations with other departments of knowledge, it must preserve toward them a due consideration. It must venture upon prediction with circumspection. It must take care, on the one hand, not to set too narrow limits to the possibilities of discovery; on the other, it must be quick to discern the directions of advance, and to utilize the smallest suggestion to promote discovery. It must be fruitful in working hypotheses, but it must test these with unsparing rigor before it offers them as a part of established truth.

Moreover, in order that it may advance beyond the boundaries of present knowledge, it must keep fully and constantly informed of the position of the ever-varying line which marks the limits of the known. It must have and use all the publications in which are recorded the work done by others in all the various fields of research. It must not waste its energies in doing again what has already been well done. Beginning its work where others have left off, it must carry out into the misty region of hypothesis the most complete methods known for the solution of the problems it has attacked. Not contented alone with receiving the work of others, it must furnish its methods and results for publication, thus contributing its part to the interchange and discussion of opinions by which discoveries finally become an integral part of truth. It must recognize the importance of making the scientific literature of the day the repository of scientific progress; so that every advance, whether of theoretic or applied science, may find a record in its pages.

The year 1883 opens auspiciously. The scientific sky is clear, and the outlook promising. If true to itself and to its surroundings, American science has nothing to fear from the future. With the increase of a generous people, and the spread of intelligent scientific thought, it has every thing to hope. Under these favorable circumstances, SCIENCE enters upon its career. May it early recognize the conditions of this certain progress, and be on the alert to help it forward.

PHOTOGRAPHING THE CORONA WITHOUT AN ECLIPSE.

Perhaps the most important observation since the discovery by Jannsen and Lockyer that the solar chromosphere could be studied without an eclipse, has recently been made by Mr. Huggins,[1] the well-known English astronomer.

When the spectroscope had been found capable of bringing this important region into daily view, there still remained the corona, whose feeble light and nearly continuous spectrum defied all attempts to see it through the overpowering glare of our own atmosphere; which, even in the purest sky, acts as a luminous veil between us and the object. It is very easy at all times to cut off the sun's direct light by a screen: unless the screen be at an enormous distance from the eye, however, this glare is not diminished by its use. Mr. Huggins's method is founded principally on two considerations.

The first is, that the principal coronal radiation (as found in Egypt by Dr. Schuster in the late eclipse) occupies a narrow part of the spectrum between G and H, while the atmospheric glare consists of light of all refrangibilities. As this coronal radiation, though occupying narrow limits of wavelength, is not monochromatic in the sense in which that of the chromosphere is, he has not employed the prism to disperse the atmospheric glare, but certain absorbent media to shut it out; choosing those, of course, most transparent to this violet light alone. The best isolating medium has been thus far found to be potassic permanganate.

The second consideration is, that since the G—H region is near the limit of vision, where, though the retina responds but feebly, the photographic plate is active; and since the latter is sensitive to feeble distinctions of light, and preserves a permanent record of them, it is best to use it, rather than the eye. Dr. Huggins has worked with a Newtonian telescope having a mirror of six inches aperture and three and one-half feet focus. By selecting fine days, he has obtained, between last June and September, twenty plates, showing what appear to be the rays and streamers of the sun's inner corona.

As at least one European observer of distinction deceived himself by the supposition that he had obtained a naked-eye view of the inna without an eclipse, and as the appear- the about the sun caused by inequalities in cially t ury, and our own atmosphere are most perplexing, and so corona-like as almost to 'deceive the very elect,' the reader will be interested in perusing the following letter to Mr. Huggins from Captain Abney, the eminent photographer: —

"A careful examination of your series of sun-photographs, taken with absorbing media, convinces me that your claim to having secured photographs of the corona with an uneclipsed sun is fully established. A comparison of your photographs with those obtained during the eclipse which took place in May last shows not only that the general features are the same, but also that details, such as rifts and streamers, have the same position and form. If in your case the coronal appearances be due to instrumental causes, I take it that the eclipse photographs are equally untrustworthy, and that my lens and your reflector have the same optical defects. I think that evidence by means of photography, of the existence of a corona at all, is as clearly shown in the one case as in the other."

This is a clear opinion from a master of the subject; but Dr. Huggins's own caution in statement, as well as skill in research, are, without it, sufficient to predispose us to believe, that, in spite of its difficulties, the problem of securing the forms of the inner corona without an eclipse has been, in principle, solved. What these difficulties are, only those few who have experimented in this particular direction know. As one of this number, the writer can only express his sense of the great consequence of the result reached, and his admiration of the skill employed in obtaining it. It is given to few to crown such a scientific life as that of Dr. Huggins, by a discovery of such importance. S. P. Langley.

[1] ...ethod of photographing the solar corona without an ...r read at the Royal society by William Huggins, F.R.S., Dec. 21.

A SINGULAR METEORIC PHENOMENON.

We are indebted to the favor of the Bureau of Navigation, for the privilege of publishing the following very interesting letter of Captain Belknap, addressed to Commodore John G. Walker, United-States Navy, Chief of Bureau of Navigation, Navy Department, Washington.

U. S. S. Alaska, at Sea,
lat. 37° 54′ N., long. 124° 25′ W.
Dec. 15, 1882.

Sir, — I beg to report, that on the evening of the 12th inst., a few minutes after sunset, and in lat. 38° 21′ N., long. 134° 07′ W., a remarkable phenomenon was witnessed in the western horizon from the deck of this ship.

The sun had set clear, leaving the lower sky streaked with gorgeous tints of green and red, while the new moon, three days old, gave out a peculiar red light of singular brilliancy. Suddenly, at three minutes before five o'clock, a loud rushing noise was heard, like that of a large rocket descending from the zenith with immense force and velocity. It was a meteor, of course; and when within some 10° of the horizon it exploded with great noise and flame, the glowing fragments streaming down into the sea like huge sparks and sprays of fire.

FIG. 1. — Directly after explosion.

Then came the most wonderful part of the phenomenon; for, at the point in the heavens where the meteor burst, there appeared a figure like the shape of an immense distaff, all aglow with a bluish-white light of the most intense brilliancy. It kept that form for perhaps two minutes, when it began to lengthen upwards, and grow wavy and zigzag in outline from the action of the wind, and gradually diminishing in breadth, until it became a fine, faint spiral line, at its upper end dissolving into the fast-gathering clouds the meteor seemed to have evoked. It so remained, a gorgeous scroll of light, emblazoning an arc of some 15° or 20° in the heavens, and with all its vividness and brilliancy of coloring, for ten minutes longer, when it began to fade, and finally disappeared at eleven minutes past five o'clock, apparent time. So grand and startling had been the effect produced, that it might have been likened to a thunderbolt and its trail indelibly engraved upon the sky. All on board gathered on deck to look at the wonderful phenomenon, and all said they had never seen so marvellous a sight before. Had the meteor struck the ship, it would doubtless have been the last of the Alaska, and no vestige would have been left to tell the tale of her loss.

FIG. 2. — From 2 to 3 minutes after explosion.

And to those who witnessed this strange and unwonted manifestation of the forces of the universe comes the suggestion of possible unthought-of cause of sometime disasters at sea.

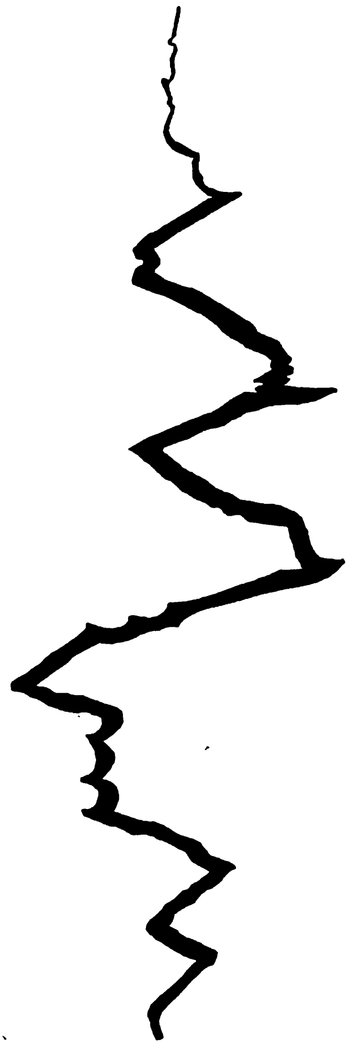


FIG. 3. — At 5.09 P.M.

I beg to enclose sketches giving a faint idea of a portion of the phenomena described above.

Very respectfully, your obedient servant,

GEO. E. BELKNAP,

Captain U. S. N., Commanding.

[On the evening of June 29, 1860, when encamped at the mouth of the Red River, on the southern shore of Lake Winnipeg, the astronomical party, sent that year by the Nautical almanac office to observe, July 18, on the

Saskatchewan, the eclipse of the sun, saw a meteor flash in the northern sky, the trail of which remained visible near the horizon for about three-quarters of an hour, taking on a form somewhat resembling the later ones depicted by Captain Belknap, and in that time changing its position considerably, both relative and absolute.]

THE TYPHOON AT MANILA, PHILIPPINE ISLANDS, OCT. 20, 1882.

THE accompanying diagram gives an abstract of the curves traced by the meteorological instruments at the observatory in Manila, Philippine Islands, during the typhoon which swept over the central provinces of Luzon, Oct. 20, 1882, from the time when the first indications were noticed at the south-east of Manila, at noon of the 19th. The observers were the Jesuit Fathers under Padre Faura, and the instruments those once used by Father Secchi at Rome. Observations made at the marine and telegraph offices in the city, and on the national war vessels on the coast, are incorporated in the diagram.

Barometer. — The mercury descended at noon of the 19th to 756 mm. (about 29½); varying little till near midnight (19–20th), when it began to go down more rapidly. It has been noticed, that, when it descends to this point in the Philippine Archipelago, it always indicates a storm at a considerable distance. Up to dark there had not been observed the cirrostratus clouds, nor the solar halos, nor the characteristic sunset colors, which usually indicate the proximity and direction of approach of a typhoon. There remained only the direction of the superficial winds oscillating from north-east to north-west (of little value), and the course of the clouds, which, till 1 A.M. of the 20th, came from the north-east. At 3 P.M. of the 19th, warning was given from the observatory, 'Signs of a cyclone at the south-east;' but there were no unusual barometric changes. It was at this time more than 370 miles away, with a destructive diameter of about 80 or 90 miles.

From 10 P.M. of the 19th to 4 A.M. of the 20th, the barometer went down more than .15 of an inch: at this time warnings were sent to all the public offices that danger was imminent, and word was telegraphed to Hong Kong that a typhoon was beginning at the east of Manila, and was proceeding west-north-west. At midnight it began to fall more rapidly till 8 A.M. of the 20th; and then, in two hours, fell from 746 mm. (29) to 728 mm. (28.4). About noon it began to rise as rapidly till 2 P.M., and then gradually to 756 mm. (29½) at 10 P.M.

Thermometer. — At noon of the 19th it stood at 32° C. (89½° F.); it gradually went down to 24° C. (75° F.) at 7 P.M.; it remained at this point till about 11 A.M. of the 20th, and then in less than an hour went up to 31° C. (88° F.), and descended again to 24° C. (75° F.), at 10 P.M. standing at 26° C. (79° F.).

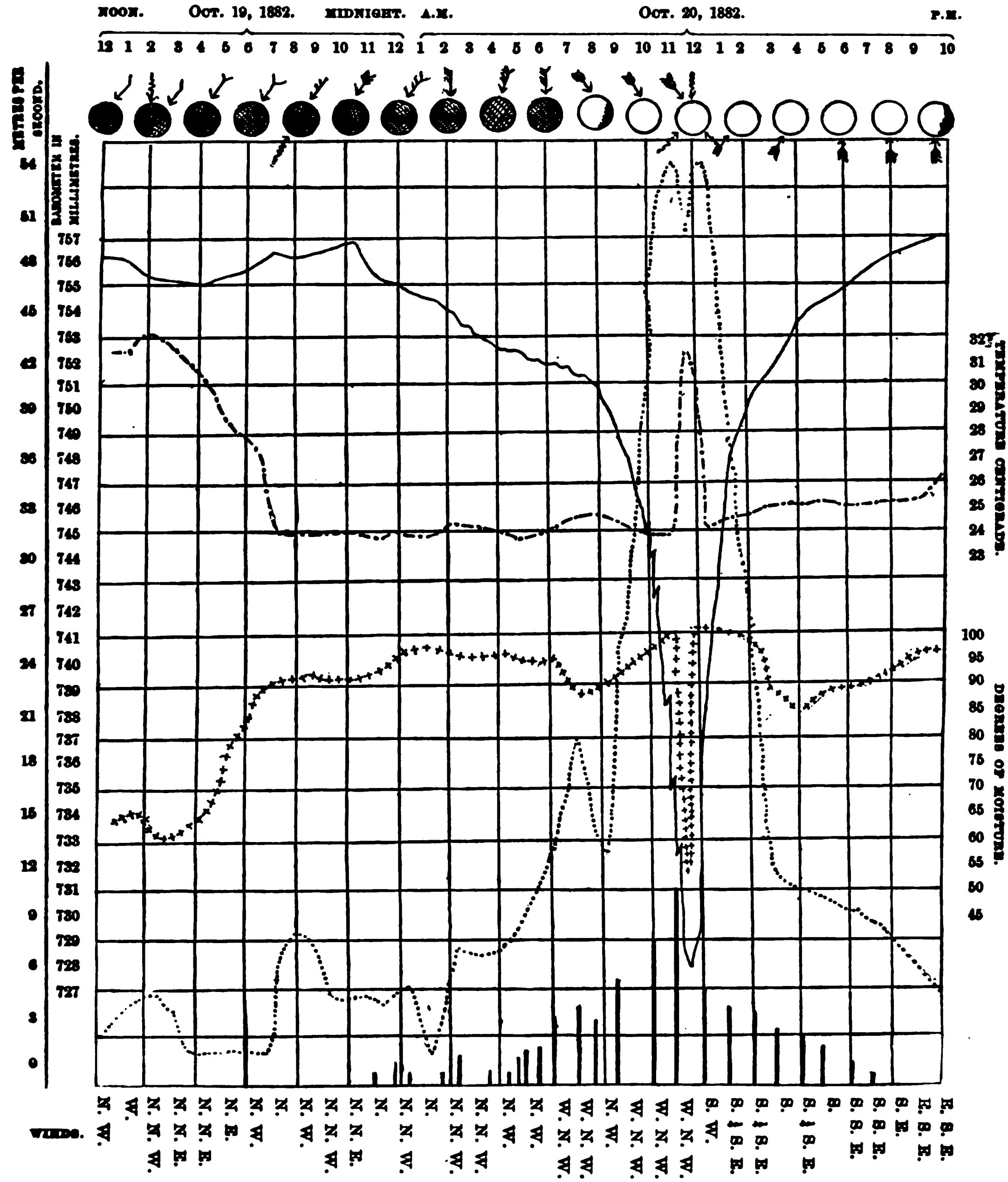
Moisture of Air. — It occurred toward the end of the rainy season, and during the south-west monsoon. At noon of the 19th it was 65, rapidly rising between 2 and 6 P.M. to 90, and varying from that to 95 till 10 A.M. of the 20th; at 10.30 it was 100; then in half an hour it went down to 55, and back again to 100, thence gradually declining to 90–95 at 10 P.M.

Velocity of Wind. — There was comparative stillness till 6.30 P.M. of the 19th; from then to 4 A.M. of the 20th it rarely exceeded 20 feet per second; then in three hours it rose to 63 feet, and, after a half-hour's descent to 40, in 1½ hours, or at 11 A.M., reached at least 180, and probably more, as at the height of the gale the registering instrument was carried away: this is equivalent to about 125 miles an hour, and the velocity may have attained 140 miles. In an hour it began to diminish rapidly, and at 1.30 P.M. had gone down to 33 feet, and to 13 at 10 P.M. After several sudden changes, at 2 A.M. it began to blow from the north-west, and so continued till about noon, when it shifted suddenly to the south-west for half an hour, and then blew from south-south-east and east-south-east up to 10 P.M.

Rain. — Rain began to fall just before midnight, 19–20th, and increased, with occasional lulls, to about 11 A.M., when it fell in torrents; after that it gradually decreased, and ceased about 8 P.M. It was accompanied by some lightning.

Direction. — The storm entered the archipelago over the Catanduanes Islands, near Tabaco and Albay, and went across the east of the North Camarines, near Daet, judging from the successive positions of the vortex, then passing over Manila and to the China Sea, by Subig. The course was therefore from south-east to north-west, and its velocity 19 miles an hour, the greatest ever known here.

Form. — The barometer went down much more slowly than it ascended; whence it may be deduced that the curves of equal pressure were not circular, being wider at the anterior than at the posterior part of the typhoon, forming a kind of ellipse, in which one of the foci occupied the vortex. The tracing of the



Barometric curve.
Velocity of wind, as given by the anemometer.
+ + + Relative moisture.
Thermometric curve.
Condition of sky, and direction of clouds.

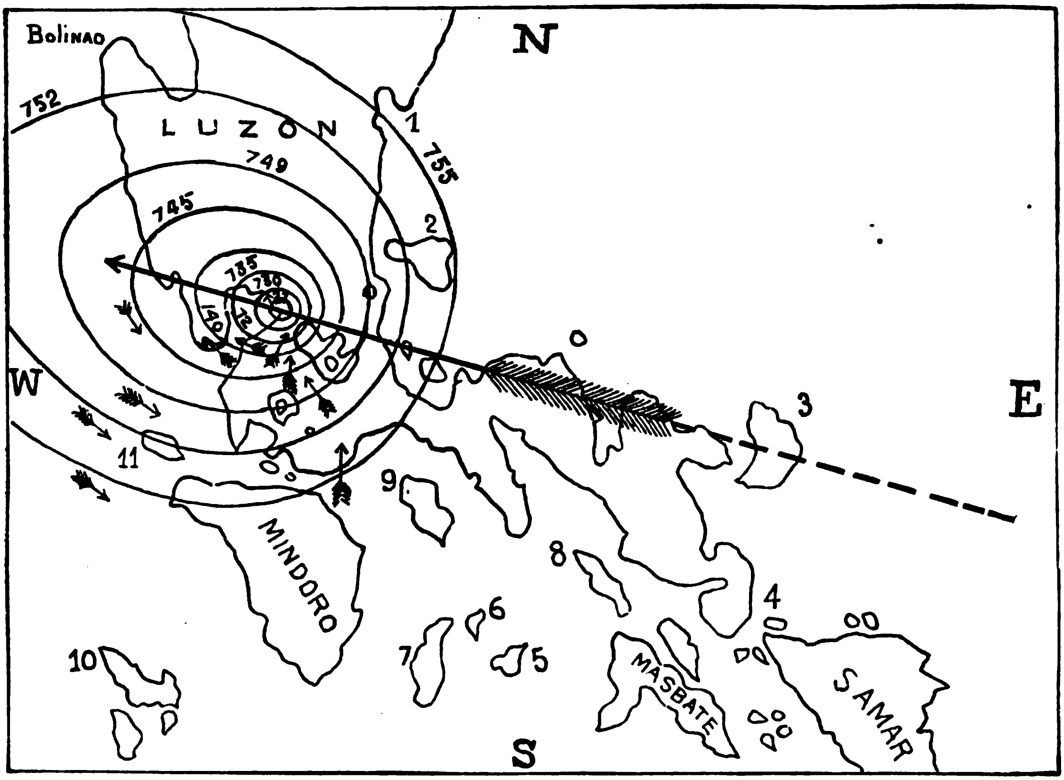
The arrows indicate not only the direction of the clouds, but also their velocity, represented by the barbs, six marking a hurricane force; the zigzag arrows indicate lightnings, and the point of the horizon where they were observed; the empty circles indicate a sky completely hidden.

The heavy vertical black lines at the bottom of the chart indicate the amount of rain.

isobaric lines is strongly in favor of the theory of converging winds, and apparently fatal to that of the long-held one of circular winds.

Vortex. — At 11.46 A.M. (20th), after a violent rush from the west-north-west, Manila was in the vortex. The calm was not absolute, but with alternate gusts and lulls for about eight minutes; at 11.52 the calm was absolute for two minutes; then alternate calm and gusts from the south-west. Blue sky was not seen, but it cleared to a dense watery vapor; the dark belt of the storm could be traced on the horizon. The diameter of the vortex was probably not more than 14 or 16 miles.

Changes. — The most striking phenomenon was the sudden change of temperature and hygrometric condition of the air, as revealed by the curves traced; the former from 75° to 88° F., and the latter from 53 (rarely observed here, and only in April and May) up to saturation. Persons who opened their windows during the calm were instantly compelled to close them, for the air 'burned' as in the Italian sirocco.



MAP SHOWING THE COURSE OF THE HURRICANE, AND THE DISTRIBUTION OF THE ISOBARIC LINES AROUND THE CENTRE.

1. — Bay of Casiguran. 2. — Island of Polillo. 3. — Catanduanes Islands. 4. — Strait of San Bernardino. 5. — Island of Sibuyan. 6. — Island of Romblon. 7. — Island of Tablas. 8. — Island of Burias. 9. — Island of Marinduque. 10. — Calamianes Islands. 11. — Island of Luban. 12. — Bay of Manila. The large arrow indicates the course of the hurricane, and horizontal section of the same, as it passed over Manila. 755 to 727 mm. (29.45–28.35 in.) the fall of the barometer.

Barometer. — The lowest barometer was at 11.40, or 6 minutes before entering the relative, and 10–12 before the absolute, calm; at this time Manila was probably the nearest to the centre of the vortex. At 11.54 it began to rise rapidly, the wind changing suddenly to the south-west, but with equal violence. The blow lasted $2\frac{1}{2}$ hours; and its traced fury for the last half of the diagram was estimated, but not observed for want of instruments.

At 12.30 the dense clouds began to rise quickly, indicating that at the posterior part of the storm the winds had also mounted higher. It was peculiarly destructive, as Manila was exactly at the point of this sudden change of elevation.

Force. — The observatory is about 113 feet above sea-level. Just before 11 A.M. the wind tore up a palma brava some 1,000 feet

away, raised it to the height of the observatory, and carried it against the cast-iron column through which pass the connections between the top and the registering apparatus; destroying the same, and preventing further observation of the anemometer. Manila was in the centre of the greatest violence; at a short distance from the city, the barometer stood 3½ tenths higher.

Effects. — The typhoon was the most severe that has visited the islands for fifty years. Houses were unroofed, vessels driven ashore, whole villages prostrated, trees torn up by the roots; metal plates, tiles, timbers, and heavy weights were carried to great heights and distances. Millions of property were destroyed in the city and its suburbs; the growing cane and hemp in the provinces were seriously damaged, thousands of people are houseless and penniless, and general distress and business prostration are the result. The rain saturated every thing that the wind exposed; what was left, more or less injured, was further ruined by another typhoon of almost equal violence, which occurred Nov. 5.

Samuel Kneeland.

CAPTAIN C. E. DUTTON ON THE HAWAIIANS.

Captain Dutton of the United-States Army has just returned from a sojourn of seven months on the Hawaiian Islands, where he went for the purpose of studying the volcanic phenomena. Although most of his time was necessarily devoted to geological investigation, he yet found time to collect a large mass of ethnological data, which he presented in a most interesting form at a meeting of the Anthropological society of Washington, held Jan. 2.

He said that in color the inhabitants are of a bronze shade about midway between the color of the North-American Indian and the Malayan. The general features, however, are very unlike those of our Indians, and partake in part of the character of the European and in part of that of the African tribes, though more strongly of the former. In stature the Hawaiians are large, and equal the Anglo-Saxon race. There are, however, two broadly marked social castes, and these differ physically almost as widely as they do socially. The ruling class are lighter in color, and larger in stature, being usually above six feet in height, and sometimes reaching six feet seven inches. They also tend to obesity, and are readily distinguishable from the lower classes in numerous other ways. The Hawaiian Islanders belong to the finer and better of the two great races of men which about equally share the Polynesian Islands. They were never cannibals, and nothing offends them more than the charge of having eaten Captain Cook.

Many facts point to the East-Indian Archipelago as the portion of the globe from which these people originally came; and among these evidences are their possession, when first seen by Europeans, of the dog, the pig, and the domestic fowl, none of which could have come from America. Their language allies them very closely to certain Bornean tribes, and particularly to the Dyaks. This affinity is especially observable in their numerals.

Their legendary lore, which is amazingly rich, also belongs to the East-Indian type, and even partakes in a striking manner of the character of that of India, Western Asia, and Egypt. Their myth relating to the creation of woman is identical with that in Genesis, and may have been borrowed from the early missionaries; but against this view is the remarkable fact that it appears in an archaic form of their language which only the priesthood can fully understand. The present king Kalakaua is much interested in the ethnology of his people, and believes in their American origin, — a belief which the speaker did not share.

The population of the Hawaiian Islands is dense, and every thing points to the conclusion that this has been the case for a very long period. The arable lands are confined to belts around the islands extending inward from six to twelve miles to the beds of lava or steep sides of the mountains. These lands are divided up into very small lots by means of stone walls.

The state of society is by no means low or savage. Society is well organized according to a rigid system. This system very closely resembles the feudal system of European history, having all the classes which characterized that system. Prior to the consolidation of all the governments of the islands by Kamehameha I., in the early part of this century, there existed on each island a number of independent kingdoms. The kings were the proprietors of all lands, which they parcelled out to subordinate chiefs, whose tenure was strictly analogous to enfiefment, with this exception, that, in addition to homage and military service, tribute was also exacted of them. The latter subdivided their fiefs among their retainers on similar conditions, and these turned them over to the lowest, or working classes, to cultivate; which latter were the true *villeins*, who were merely tenants at will. Still this latter form of tenure was the most permanent; since the chiefs were liable to be changed by military reverses and royal displeasure, while the villeins remained, as in Europe, practically *adscripti glebae*. The priesthood was almost always found supporting the king. This class maintained, down to the reign of Kamehameha II., the most despotic sway over the people, and chiefly through the principle involved in the terrible word *tabu*. The fundamental idea underlying this term is *divine prohibition*, and the penalty for the breaking of a tabu was always death. The people submitted to this in the firm belief that death in some form was certain to follow such offences; and that, if man did not inflict it, the gods surely would. Tabus were either permanent, recurrent, or merely temporary and arbitrary. Among the permanently tabued acts was that of the sexes eating together. Special tabus were prescribed by the king, with the advice of the priesthood.

The speaker went on to describe in detail the mode of subdividing the land for agricultural purposes, the skill displayed in irrigation, the principal products of the soil, the leading articles of food and how they are prepared, the character of the houses, the manufacture of tappa-cloth and of mats out of the screw pine, the culinary utensils and dishes used; the implements manufactured and the materials yielded by the country for these purposes; the modes of fishing; the kind of dress worn; the elaborate robes, cloaks, helmets, etc., made for the kings, of yellow and red feathers; and the use of nuts as candles. He further treated of the military tactics of the Hawaiians, and the arms employed; of their

canoes, and mode of navigation, by which they have frequently visited the Society Islands, a distance of 2,400 miles. They knew much of astronomy, and possessed an accurate calendar, dividing their year into twelve months of thirty days, with allowance for the bissextile. Their year begins at the time when the Pleiades rise at sunset. They count to millions, with names for all their numbers. The priests know every plant on the islands, and are especially familiar with their toxic properties. Interesting remarks were made on their language, their mythology, and their religion. Legends and royal pedigrees are handed down with great exactness by a special class who make this their only business. The language of their classic lore is archaic, and unintelligible to the common people. The genealogy of kings is traced back a hundred generations. Descent is here in the male line, but descent of property among the other classes is in the female line. This is rendered necessary from the fact, that with the exception of the queen, who is *tabu* and therefore chaste, chastity in women is regarded as a disgrace, in that it denotes a want of attractions. Monogamy prevails, but divorce is easy and sexual morality excessively lax. The dead are buried in caves in the mountains, in a sitting posture. Until recently human sacrifices were of frequent occurrence. Criminals are executed secretly with a club. Walled enclosures constituted their "cities of refuge." Their temples in the form of parallelograms were also described.

Captain Dutton closed his remarks by rapidly glancing at the influence of the missionaries, and the modern innovations and modifications in Hawaiian society.

VARIATIONS IN THE VERTICAL DUE TO ELASTICITY OF THE EARTH'S SURFACE.

IN the Philosophical magazine for December, 1882, Mr. G. H. Darwin discusses this subject. He considers first the disturbance due to variations of barometric pressure; second, those due to the rise and fall of the tides. Mr. Darwin has previously investigated "the state of stress produced in the earth by the weight of a series of parallel mountains" of such shape that the equation to the outline of the section made by a plane traversing all the mountains and valleys perpendicularly is $x = -h \cos \frac{z}{b}$; the axis of x being supposed vertical, and that of z horizontal and perpendicular to the mountain chains.

Taking the origin in "the mean horizontal surface, which equally divides the mountains and valleys," and midway one of the mountains, and letting "a, γ, be the displacements at the point x, z, vertically downwards and horizontally," he finds, when $x = 0$,

$$a = \frac{gwh}{2v} b \cos \frac{z}{b}, \quad \gamma = 0, \quad \frac{da}{dz} = -\frac{gwh}{2v} \sin \frac{z}{b}.$$

In these equations, w is "the density of the rocks of which the mountains are composed; g, gravity; v, modulus of rigidity."

If we suppose the region to have been originally a plane, such as would be formed by toppling over the upper half of each mountain into the neighboring valley, the quantity $\frac{da}{dz}$ above is the present real inclination of what was originally the horizontal surface stratum.

The apparent inclination, however, as measured by means of the plumb-line, is something different from the above, owing to the change in the direction of the latter due to the changed distribution of the attracting masses about it. One of the most interesting portions of Mr. Darwin's present paper is the proof of a very simple ratio, for any such case as that now under consideration, between the deflection of the plumb-line and the slope $\frac{da}{dz}$ of the stratum $x = 0$.

This relation, which was pointed out to Mr. Darwin by Sir William Thomson, though the proof here given is due to the former alone, is as follows:—

If δ be the earth's mean density, r the earth's radius, and v, g, as above, the deflection bears to slope the same ratio as $\frac{v}{g}$ to $\frac{1}{3} r \delta$. "This ratio is independent of the wave-length $2 \pi b$ of the undulating surface, of the position of the origin, and of the azimuth in the plane of the line normal to the ridges and valleys. Therefore the proposition is true of any combination whatever of harmonic undulations; and as any inequality may be built up of harmonic undulations, it is generally true of inequalities of any shape whatever." With rigidity as great as that of steel, the slope is $1\frac{1}{4}$ times as great as the deflection.

"In the problem of the mountains, $w h$ is the mass of a column of rock of one square centimetre in section, and of length equal to the height of the crests of the mountains above the mean horizontal plane. In the barometric problem, $w h$ must be taken as the mass of a column of mercury, of a square centimetre in section, and equal in height to a half of the maximum range of the barometer."

This maximum range is assumed to be 5 centimetres. The rigidity of the earth is supposed to be 3×10^8 million grammes per square centimetre,—greater than that of the most rigid glass. The distance from the region of high to that of low barometer is taken as 1,500 miles.

With these data, it is found "that the ground is 9 centimetres higher under the barometric depression than under the elevation."

The maximum slope of the surface, which is found midway between the regions of high and low barometer, is 0''.0117; and for the maximum apparent deflection of the plumb-line, "this is augmented to 0''.0146 when we include the true deflection due to the attraction of the air." [1]

In the problem of the tides, Mr. Darwin imagines, as before, "an infinite horizontal plane which bounds, in one direction, an infinite, incompressible, elastic solid." Upon this he lays off straight strips of equal and uniform width, representing alternately areas of land and of water. At full tide, the surface will be such that for it x will be a discontinuous periodic function of z. This function having been developed according to Fourier's theorem, the results of the previous investigations become applicable.

It is thus found that "midway in the ocean and on the land there are nodal lines, which always remain in the undisturbed surface," whether the tide be high or low on either coast; "that the land-regions remain very nearly flat, rotating about the nodal line, but with slight curvature near the coasts."

[1] Mr. Darwin remarks that this last result is independent of the wave-length of the barometric inequality, and so it appears from the formula. It would seem, however, that the above correction for the attraction of the air is only applicable when the wave-length is very considerable compared with the height of the effective atmosphere.

This apparent deflection is so great, that, with the deflections caused by the tides, Mr. Darwin concludes it will probably forever mask the lunar disturbance of the plumb-line, the amplitude of this latter disturbance being by calculation only 0''.0216. This conclusion will probably put an end to the laborious and refined experiments which he and his brother have been conducting for two or three years in order to detect and measure the lunar action.

Assuming the width of the seas and continents to be 3,900 miles, the rigidity of the earth to be 3×10^8, as above, and the range of the tides to be 80 centimetres, Mr. Darwin computes and gives tables of the slopes, real and apparent, of the land at various distances from the coast. Such deflections, he thinks, might actually be observed at points near the coast, and the measurements thus obtained might possibly serve as a basis for computing a more trustworthy value of the earth's rigidity than we now possess.

Under the conditions above assumed, the amplitude of vertical displacement between high and low tide is 11.37 centimetres on the land at the coast.

"As long as $h\,l$" — i.e., the semi-range of the tide multiplied by the width of a sea or continent — "remains constant, this vertical displacement remains the same; hence the high tides of ten or fifteen feet which are actually observed on the coasts of narrow seas must probably produce vertical oscillations of quite the same order as that computed." E. H. HALL.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

Age of the rocks on the northern shore of Lake Superior.

PERMIT me, through the medium of your journal, to correct a mistake which Prof. N. H. Winchell has made (*Tenth ann. rep. surv. Minn.*, p. 125) in stating that I regard the trap and sandstone of Lake Superior as Huronian.

Up to the present time I was not in a position, never having examined them, to express any opinion about the Lake Superior formations referred to.

During the past summer I have somewhat closely examined these around the whole of the Canadian shores, from Prince Arthur's Landing to Sault St. Mary, including the shores of Thunder Bay, Black Bay, and Nipigon Bay and Straits. I spent two months in this examination, travelling from point to point in a small boat.

My opinion now, respecting the character and age, — within certain limits — of these rocks is very decided, and is as follows: —

They occupy the geological interval elsewhere filled by those divisions of the great lower paleozoic system which underlie the Trenton group. Various considerations point to the Potsdam and Primordial Silurian (Lower Cambrian) as their nearest equivalents. They are entirely unconformable to, and physically distinct from, the Huronian. They are divisible on the Canadian shores into two, perhaps three, groups, between which there may be slight unconformities. These, however, are quite likely only such as might result from the intermingling of ordinary sedimentary strata with irregular layers of erupted volcanic material, molten, muddy, and fragmentary; the whole being subsequently, and even during their accumulation, further disturbed by faulting, and the irruption of igneous dykes and masses.

To my mind, there can be no doubt as to the nature of the causes which have built up the vast masses of strata, which now, together with ordinary sedimentary layers, form the so-called upper copper-bearing rocks of Lake Superior. They are essentially volcanic, subaërial, and subaqueous formations, and in every sense analogous to the wide-spread tertiary volcanic rocks of Australia and other regions. The only differences are their greater antiquity, and the consequent greater changes and modifications they have undergone through the operation of long-continued metamorphic agencies, disturbance, and denudation; though these changes are far less than those which the rocks of the same age, and to some extent similar origin, have undergone in eastern America and in Britain; and in this they correspond with the higher fossiliferous groups in the respective regions.

The groups in ascending order are, —

1. Black shales, flinty and argillaceous, banded chert, with black dolomites and beds of fine-grained dark-gray sandstone with mica in the bedding planes; the whole interbedded with massive diabase or dolerite, often columnar, the columns vertical. — Pie Island, McKay's Mountain, Thunder Cape, etc.

2. Red conglomerates, red and white and green mottled shales, red and white sandstones and dolomites; no gray or black beds. At perhaps a hundred and fifty or two hundred feet from the base, these become interstratified with massive beds of volcanic material, amygdaloids, melaphyres, tuffs, etc., making many thousand feet of strata. — East shores of Black Bay, Nipigon Strait, St. Ignace and other islands, Michipicoton Island, Gargantua, Mamainse, etc.

3. The Sault St. Mary sandstones. These may be only the upper part of 2, without any intermingling of volcanic material. The exposures on the Canadian side are too fragmentary and isolated to decide this. In any case the St. Mary sandstones are not younger than Chazy (Cambro Silurian), but in the absence of fossils it is impossible to correlate the Lake Superior groups exactly with any one of the subdivisions of the New York or the Atlantic coast series. This, however, is no sufficient reason for inventing and adopting new and unknown names for them; and I prefer to call them all Lower Cambrian, which includes Potsdam and Primordial Silurian. There is, at present, no evidence whatever of their holding any other place in the geological series. Through overlapping and faulting, all three divisions are found locally in contact, both with Huronian and with Laurentian rocks. The dips are generally south-eastward, but vary greatly in amount, those of division 2 being often locally much higher than any observed either in divisions 1 or 3. A. R. C. SELWYN.

Geol. and nat.-hist. survey of Canada.
Ottawa, December, 1882.

Movement of the arms in walking.

Every man has observed that the tendency to swing the arms while walking is a most natural one. The action is rhythmical, the anterior and posterior extremities of opposite sides of the body moving in unison. It is also involuntary, being performed most readily when thought is not bestowed upon it. When voluntarily suspended, as in the American army, it gives an air of 'stiffness.'

In view of these facts, does it not seem that the statement of Prof. J. D. Dana (Cephalization; *Amer. journ. sc.*, xli. 1866, p. 167), sanctioned by Dr. T. Gill (Classif. families of mammals, 1872, p. 50), — namely, that "Man stands alone among mammals in having the fore-limbs not only prehensile, but *out of the inferior series, the posterior pair being the sole locomotive organs*," — must be somewhat modified? Have we not at least a ghost of a pre-existing function? Does man walk by means of his feet and legs alone? FREDERICK W. TRUE.

U. S. national museum, Washington, D.C.,
Nov. 18, 1882.

Cleaning birds.

When obliged to wash birds, collectors will find it an advantage to use salt and water instead of plain

water. The salt prevents the solution of the blood-globules and consequent diffusion of the red haemaglobin. J. AMORY JEFFRIES.

THE ORIGIN OF CULTIVATED PLANTS.

Origine des plantes cultivées, par ALPH. DE CANDOLLE. (*Bibliothèque sc. internat., tom. xliii.*) Paris: Baillière & Cie., 1883. 8vo.

IT is a common saying, that the plants with which man has most to do, and which have rendered him the greatest service, are those of which botanists know the least. That this should hold true of the plants of immemorial cultivation, as regards both their limitation in species and their sources, is not to be wondered at. The reason why many of these cannot be identified with wild originals is because, in all probability, the originals have long been extinct. Even when spontaneous examples have been found, it is sometimes far more probable that these are the offspring of the cultivated plant relapsed into wildness, than that they are vestiges of an original stock. Indeed, plants of comparatively recent acquisition to Europe are still puzzles; of not a few the question is still open whether they originated in the new or in the old world. The herbalists and ante-Linnean botanists gave little attention to the original sources of the plants they described, and Linné still less. Following erroneous indications, he assigned the common sunflower to Peru; and its relative, the tubers of which we call artichokes, to Brazil; when he might have known that they both were sent to Europe from Canada. It is only within the present century that any considerable attempts have been made to solve such problems. Robert Brown, Humboldt, and the elder De Candolle opened the way; and Alphonse De Candolle, who has particular aptitude for this class of investigations, is one of the few who have undertaken to discuss this subject systematically. Almost thirty years ago, in his Géographie botanique raisonée (2 vols. 8vo, 1855), just before the Darwinian deluge, which swept away some of the old landmarks, and changed the face of many things, De Candolle discussed in detail the changes which have taken place in the habitation of species, and has a long chapter on the geographical origin of cultivated plants. In this the then existing knowledge is well brought up to date, systematized, and critically treated.

This book is out of print. Greatly as it is needed, the author, who is older than he was, recoils before the labor of a new edition of the whole work. But he has taken up the subject of the origin of cultivated plants anew, and the present volume is the result.

The number of species of cultivated plants here passed in review seems at first sight to be wonderfully small, viz., only 247, or, reducing certain races to their supposed types, little over 240. But species cultivated for ornament and for medicine or for perfume are rigidly excluded; while, on the other hand, so insignificant a forage-plant as spurrey, so poor and weedy a pottage-plant as purslane, a plant which we know only in ornamental culture and for its medicinal product, castor-oil, and a fruit-tree of such slight pomological importance as the American persimmon, are included. The latter and its old-world analogue are, indeed, only enumerated; but no one cultivates persimmons in this country. It is said that no plant of established field-culture has ever gone out of cultivation, at least in modern times, except perhaps woad; but, thanks to the chemists, madder is doomed already, and indigo is to follow.

Although Humboldt could affirm, so late as in the year 1807, that the original country of the vegetables most useful to man remains an impenetrable secret, so great progress seems to have been since made that De Candolle is able to assort his 247 species into 199 furnished by the old world, 45 by America, and only three which are still doubtful in this regard. Here the chestnut, the red currant, the common mushroom, and the strawberry are counted as of European, properly enough; since they were first cultivated in the old world, although indigenous to North America as well. The latter country makes a poor show indeed, when it is said that its only indigenous nutritive plants worth cultivating are the sunflower-artichoke and a pumpkin, though Indian rice (Zizania) might have been turned to account if it were not for the true rice. We are not so clear as to any original inferiority, nor that these numbers might not have been more nearly equal if civilization had begun as early in the new as in the old world. Europe had the great advantage of lying adjacent to two other continents, and of being colonized from them by races which were already agricultural.

As respects the three plants of doubtful country, two are species of Cucurbita (moschata and ficifolia), comparatively unimportant and little known, which have reached Europe only recently, the latter within thirty or forty years; and the third is Phaseolus vulgaris, the bean of the Americans, whose right to it we propose to claim. And we would suggest that

its place in the list should be taken by the cocoanut, the only esculent species common to the two worlds within the tropics which we have reason to suppose was carried or drifted across the Pacific in prehistoric times. Being a littoral tree, with fruit capable of enduring long exposure to salt water, its dispersion is not so surprising. The question is, in which direction the dispersion was effected; and that perhaps can never be determined. In his general list De Candolle includes the Cocos nucifera among the plants of old-world origin, with queries whether of the Indian archipelago, or of Polynesia. In his former treatise he inclined to the theory of a transmission westward from the Pacific coast of Central America: in the body of the present work, after full statements *pro* and *con*, he is disposed to reverse his former opinion. But, as the dispersion may have been mainly by natural agencies, the question may be relegated to another class of inquiries. The presumption arising from the fact that all other species of Cocos are American, may be offset by the asserted fact that, although the tree formed forests on the islands off Panama when these were first visited by Europeans, it would appear to have only recently reached the West Indies and the adjacent main. So useful a tree, if indigenous to one side of the isthmus, would have been transported to the other and to the islands beyond by the very earliest races of men. As to oceanic transport, judging from the charts, the drifting of cocoanuts from America to Polynesia by the great current south of the equator seems hardly more or less likely than the reverse by the return equatorial current north of it.

It would be well to give some account of our author's method of investigation and exposition, of the kinds of evidence which are brought to bear upon the questions discussed, botanical, paleontological and archeological, historical and linguistic, each bringing some light of its own sort, and in their coincidence giving all the assurance of which such inquiries admit. It would be interesting to show, moreover, that although in most cases the continent or even the country from which each plant came to Europe, or in which it has been immemorially cultivated, has been fairly well ascertained, their origin or parentage has not. Only one-third of them are really known to botanists in a natural or wild state; and from this number subtraction may be made of such as have been detected only once or twice, and which may merely have run wild: the common tobacco-plant of the new world, and the bean of the old, are in this category. On the other hand, there are several which botanists confidently trace to indigenous originals from which the cultivated plant has undergone considerable alteration: of such are the olive, the vine of the old world, flax, and the garden poppy; and in America, the potato, the sunflower-artichoke, and the tomato. But we know not, and we probably shall never discover, the particular source or origin of the cereal grains of the old world, and of maize in the new; of sorghum and sugar-cane; of the pea, lentil, chick-pea, and peanut, and of the common white bean; of sweet-potato and yams; and nearly the same may be said of the peach, oranges and lemons, and of all squashes and pumpkins.

But we must conclude our brief review with a note upon two or three plants, the early history of which concerns our own country.

Phaseolus vulgaris, our common bean,[1] ranks in De Candolle's table as one of the three esculent plants, the home of which, even as to continent, is completely unknown. Linné credited it to India, as he did our Lima bean also; but he took no pains to investigate such questions. This has been so generally followed in the books, that even the Flora of British India in 1879 admits the species, adding that it is not anywhere clearly known as a wild plant. But Alph. De Candolle, in his former work, had discarded this view, on the ground that it had no Sanscrit name, and that there was no evidence of its early cultivation in India or farther East. Adhering, however, to the idea that our plant was the Dolichos and the Phaseolus or Phaselos of the Greeks, and of the Romans in the time of the Empire, he conjectured that its probable home was in some part of north-western Asia. But recently, as "no one would have dreamed of looking for its origin in the new world," he was greatly surprised when its fruits and seeds were found to abound in the tombs of the old Peruvians at Ancon, accompanied by many other grains or vegetable products, every one of them exclusively American. In his present very careful article he admits that we cannot be sure that it was known in Europe before the discovery of America, and that directly afterwards many varieties of it appeared all at once in the gardens, and the authors of the time began to speak of them; that most of the related species of the genus belong to South America, where, moreover, many sorts of beans were in cultivation before the

[1] Bean in Great Britain is Faba (the fève of the French), and the varieties of Phaseolus are called French beans.

coming of the Spaniards: and the idea that it might have been native to both hemispheres is discarded as altogether improbable. Upon this showing, it would appear that the plant should have been set down as of American, rather than of wholly unknown, origin. Indeed, when all the evidence is brought out, the discovery of these beans in the Ancon tombs need excite no more surprise than that of the maize which accompanied them.

For maize, beans, and pumpkins were cultivated together, immemorially, all the way from the Isthmus to Canada. And, although some of the sorts of beans mentioned by Oviedo in 1526, as raised in great abundance in Nicaragua where they are native, and also of those everywhere met with by De Soto (1539–42) in his march from Tampa Bay in Florida to the Mississippi, doubtless belonged to Phaseolus lunatus, yet most if not all of those which at the same early period Jacques Cartier found cultivated by the Indians of Canada, must have belonged to Phaseolus vulgaris, or its dwarf variety P. nanus; for only these are well adapted to the climate of Canada especially the low and precocious variety, which alone has time to mature between the spring and the autumn frosts. Indeed those same beans, derived from the Indians along with maize and pumpkins, have doubtless continued here in New England in direct descent, to form that staple diet for which the northern part of the coast of Massachusetts has long been famous; so that when Rufus Choate, defending a ship-captain against a charge of ill-treatment in having fed his crew exclusively upon it, rehearsed, in his accustomed affluence of language, the praises of "that excellent esculent and superlatively succulent vegetable, the bean," he was celebrating the good qualities of a distinctively and aboriginally American article of food.

We are not to suppose, however, that this species had its home in North America, at least north of Mexico. The same may be said of our squashes and pumpkin, for which similar reclamation may be attempted upon another occasion.

The cultivators of more than one department of science have reason to thank our author for having returned in mature age to the studies of a third of a century ago, and to admire the thoroughness, patience, sound judgment, affluence of knowledge, and felicity of exposition, which characterize this, as indeed they do all his writings. We are well pleased that the first number of our new journal should introduce to the American public an important contribution to science by De Candolle. ASA GRAY.

NATURAL HISTORY OF MINNESOTA.

The geological and natural-history survey of Minnesota. The tenth annual report for the year 1881. N. H. Winchell, State geologist. St. Paul: 1882. 254 p., 14 pl. 8vo.

THE principal part of this volume consists in the Preliminary list of rocks and Typical thin sections of the rocks of the cupriferous series in Minnesota, articles which appear to be the result of the penurious way in which Minnesota, in common with many other states, deals with her geological survey, compelling the state geologist to do work that ought to be done only by competent skilled lithologists. The results in this case, as elsewhere under similar circumstances in our country, are the same as they would be with paleontology, were the average state geologist compelled to work up all the fossils of his survey. Good lithological work requires something more than a microscope, a few thin sections, and a fair knowledge of minerals.

The convenient summary of opinions which have been held of certain rocks in the Lake-Superior region given on pp. 123–126 appears to be a digest of the more elaborate statements made in Dr. Wadsworth's notes on the geology of this district (Bull. mus. comp. zoöl., vii. No. 1), with additions of a later date, although no credit is given to that writer; on another page of SCIENCE, Mr. Selwyn takes exceptions to the views accredited to him, though Mr. Winchell would seem at first sight to be warranted in his statements from Mr. Selwyn's Canadian report of 1877–78, pp. 9 A, 14 A. The execution of the three maps accompanying the Minnesota report is to be praised.

In the zoölogical section of the report, Mr. C. L. Herrick presents a second contribution to a knowledge of the fresh-water Crustacea of the state. In this, as in his first paper (Seventh report, 1878), he limits himself almost entirely to the microscopic Entomostraca. These two papers, with Birge's Notes on Cladocera (of Cambridge, Mass., and Madison, Wisc.), comprise about all the systematic work on these animals done in this country. There is as yet, then, no basis for a discussion of their geographical distribution. According to Mr. Herrick, sixteen out of the thirty-three species described are also European. Thirteen species are new, and two new genera are established. Looking over

the specific descriptions, it appears to us that Mr. Herrick trusts too much to such characters as the number and arrangement of the joints of the antennae, which change with the growth of the individual. Even sexual maturity in these animals does not determine the limit of structural change.

Besides the microscopic forms, two species of cray-fish are recorded, — Cambarus virilis Hagen and C. signifer sp. nov. Attention is again drawn to the curious fact that size does not govern the transition from the 'second form' or sexually immature (?) male to the 'first form' or perfected state; the second form often exceeding the first in its dimensions. Zoölogists whose lot it is to live in a cray-fish country cannot be too strongly urged to study the habits and physiology of these so-called dimorphic males. Types of the 'new' species, C. signifer, kindly communicated by Mr. Herrick, prove to be C. immunis Hagen. Eleven plates accompany this memoir.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Quadrature of the circle. — In vol. xx. of the Mathematische annalen, Lindemann gave a proof of the fact that π cannot be a root of an equation of any degree with rational co-efficients. This is a most remarkable paper, as it thus contains the first direct, absolute proof that has ever been given of the impossibility of the quadrature of the circle. M. Lindemann's investigation is based upon, and presupposes a knowledge of, Hermite's earlier paper, in which he showed that e, the Napierian base, cannot be the root of an equation with rational co-efficients. The fact that Lindemann has started from Hermite's results makes his paper rather hard reading; and on this account, the author of the article at present referred to, M. Rouché, has thought it worth while to give an account of the work done by Hermite, and more recently by Lindemann, and at the same time to simplify the processes in both cases. M. Rouché has really done very little in the way of simplification, but by bringing together the proofs he has produced an interesting and valuable paper. He professes the belief that the last word has not yet been said on the subject, but that another and simpler proof will yet be given of the fact that π cannot be a root of any equation of any degree with rational co-efficients. Lindemann has certainly done a splendid piece of work in thus absolutely proving the impossibility of 'squaring the circle;' and it is only to be regretted that his work will not carry conviction to the minds of those mistaken individuals, the 'circle-squarers.' But it is hardly to be supposed that they will be convinced of the futility of their task, any more than the perpetual-motion inventors were convinced by the discovery and enunciation of the principles of the conservation of energy. — (*Nouv. annales*, Jan., 1883.) T. C. [1

Geodesic lines. — The author, Herr A. v. Braunmühl, considers the case of geodesics upon triaxial surfaces of the second order. He derives first Weierstrass' formulas for a general geodesic, and obtains forms for the entering constants in terms of the double *theta*-functions, rendering them easy of computation. Examples are given of the computation of geodesic lines in the general and in several special cases. The latter, and newer part of the paper, contains a derivation of the equations of the envelopes of geodesics, and a discussion of the same. The envelope is determined by aid of the hyperelliptic functions, and special applications are made to the ellipsoid and two sheeted hyperboloid. Numerous references are given to previous investigations. — (*Math. annalen*, xx., 1882.) T. C. [2

Abelian and theta functions. — Prof. Cayley in this memoir has reproduced with additional developments the course of lectures which he delivered in the Johns Hopkins University, in the winter and spring of 1882. The memoir has a special interest as being the first of any consequence upon this subject in the English language, and, indeed, one of the most important in any language. The chief addition to the theory consists in the determination made for the cubic curve, and also (but not as yet in a perfect form) for the quartic curve of the differential expression $d\Pi_{\xi\eta}$ (in Clebsch and Gordan's notation) or $d\,\Pi_{12}$ (in Prof. Cayley's notation) in the integral of the third kind $\int_a^\beta d\,\Pi_{\xi\eta}$ in the final normal form for which $\int_a^\beta d\,\Pi_{\xi\eta} = \int_\xi^\eta d\,\Pi_{a\beta}$ the limits and parametric points interchangeable. The notation and demonstrations of Clebsch and Gordan are much simplified, and the theory is illustrated by examples, in regard to the cubic, the nodal quartic, and the general quartic respectively. The first three chapters only of the memoir have yet appeared. — (*Amer. journ. math.*, v., 1883.) T. C. [3

PHYSICS.

Acoustics.

Instrument for measuring the intensity of aërial vibrations. — The instrument is based on an experiment described by the author (Lord Rayleigh) in the Proceedings of the Cambridge philosophical society for November, 1880; from which it appeared that a light disk, capable of moving about a vertical diameter, tends to set itself at right angles to the direction of alternating aërial currents. A brass tube is closed at one end with a glass plate, behind which is a slit through which pass rays of light from a lamp. A light mirror with attached magnets, such as are used for reflecting galvanometers, is suspended by a fine silk fibre so that the light from the slit is incident upon it at an angle of 45°, and, after reflection, passes out through the side of the tube by a glass window. A lens is so placed as to throw an image of the slit upon a scale. The opposite end of the tube, prolonged to a distance equal to that between the slit and mirror, is closed by a diaphragm of tissue-paper. A sliding tube extends for some distance beyond this. If the instrument is exposed to sounds whose half-wave-length is equal to the distance from the slit to the tissue-paper diaphragm, nodes are formed at each

end of the tube, and the mirror, being half-way between these, is at a loop. Hence it tends to set itself at right angles to the vibratory motion. This tendency is opposed by the magnetic forces; but the image on the scale shifts its position through a distance proportional to the intensity of the action. The instrument reveals an enormous disproportion between sounds which, when heard consecutively, appear to be of the same order of magnitude. — (*Phil. mag.*, Sept., 1882.) C. R. C. [4

Optics.

Absorption spectra of ozone and pernitric acid. — The places of eleven absorption bands due to ozone are catalogued by M. J. Chappuis according to wave-length. Of these, by far the most intense are those having the limits $\lambda = 609.3$ to 593.5 and $\lambda = 577.0$ to 560.0, which are Nos. 2 and 3 of the table; next in intensity is $\lambda = 535.0$ to 527.0, which is No. 5 of the table. These bands were observed in light which had traversed a tube 4.5 m. long, containing ozonized oxygen prepared at the atmospheric pressure and a temperature of 15° C. Variations of length of tube and pressure of gas were accompanied by a variation in the intensity of the absorption bands, such that the effect produced seemed proportional to the quantity of ozone traversed by the light. A lowering of temperature, however, produced, independently of change in density, an increased intensity of the bands. M. Chappuis succeeded also in observing the absorption spectrum of the blue liquid which is obtained by compressing a mixture of carbon dioxide and ozone, in which he found the two characteristic bands Nos. 2 and 3 near D; the absence of the others being attributed to the small quantity of the liquid used.

If the smallest quantity of nitrogen were present in the tube, other bands of a greater intensity appeared, which M. Hautefeuille and the author were led to attribute to an oxygen compound of nitrogen richer in oxygen than nitric acid, and to which they gave the name pernitric acid. The stronger of the bands were readily seen in a tube no longer than 0.1 m. The eight bands attributable to this substance are tabulated and described.

In the second part of his paper, the author gives a discussion of the bearing of his discoveries on the telluric lines of the solar spectrum, with the conviction that the lines 2, 3, and 5 of the ozone spectrum are present in the spectrum of the sun when at the horizon. That a part of the cause of the blue color of the sky is the presence of ozone, is also indicated. — (*Journ. de phys.*, Nov., 1882.) C. S. H. [5

Reflection of 'actinic' rays. — M. de Chardonnet finds that silver alone, of a large number of solid and liquid bodies, exerts an elective absorption on light of short wave-length. Polishing a body does not alter its action. — (*Journ. de phys.*, Dec., 1882.) C. S. H. [6

Saccharimeter. — Note by M. H. Dufet on M. Laurent's recent modification of his form of saccharimeter, by adding an absorbing plate of bichromate of potash, whereby a source of white light may be used. — (*Journ. de phys.*, Dec., 1882.) C. S. H. [7

(*Photometry.*)

Stellar photometry. — In a discussion of the accuracy attainable by the use of a neutral-tint wedge of glass for the determination of stellar magnitudes, Prof. Pritchard finds that careful measures ought not to be in error more than one-thirteenth of a magnitude. He also finds reason to believe that the ordinarily assumed law, that the brightness of a star is directly proportional to the square of the aperture of the observing telescope, may lead to sensible errors. The paper contains a table of differences of magnitudes, as determined by himself, compared with the same quantities derived from the Harvard observatory. — (*Month. not. roy. astr. soc.*, Nov., 1882.) C. S. H. [8

Photometric measurements of the sun, moon, and electric light. — According to the measurements of Pouillet, the sun is radiating 7,000 horse-power per square foot of its surface, or 50 horse-power per square inch. Sir William Thomson states that the normal current through a Swan lamp giving 20 candle-power is 1.4 amperes, with a potential of 40 to 45 volts. Hence the actual work is 61.6 ampere-volts, or watts (so-called). Dividing by 746, we find .085 horse-power for the electric activity in a Swan lamp. The filament is 3.5 inches long, and .01 inch in diameter: hence the area of the surface is .11 of a square inch, and the activity at the rate of .75 horse-power per square inch. Therefore the activity of the sun's radiation is about 67 times greater than that of a Swan lamp for an equal area.

An experiment on sunlight compared with an observation on moonlight made by our author, has led him to conclude that the surface of the moon radiates something not enormously different from one-third of the light incident upon it. The moonlight at the time and place of the observation (York, early in September, 1881, about midnight, near the time of full moon) was found to be equal to that of a candle at a distance of 230 centimetres. The luminous intensity of a cloudy sky was found, about 10 A.M. in York, during the meeting of the British association, to be such that light from it through an aperture of one inch area is equal to about one candle.

An experiment on sunlight last December showed, at one o'clock, the sunlight reaching the author's house to be of such brilliancy, that the amount coming through a pinhole in a piece of paper .09 of a centimetre diameter produced an illumination equal to that of 126 candles. The area of the candle-flame was 2.7 square centimetres, or 420 times the area of the pinhole, and therefore the intensity of the sun's light was equal to 126 × 420, or about 53,000 that of a candle-flame. — (*Electr. review*, Dec. 23, 1882.)

Sir W. Thomson's first calculation showing that a Swan lamp giving out 20 candle-power uses up only $\frac{1}{67}$ the amount of energy of the sun for the same unit of surface is interesting; but, if we include the question of the light obtained, quite a different result will be reached. The total area of the carbon filament, as we have seen, is .11 of an inch; but only half of this, or .055 inch (equal to .36 centimetre), can be seen at once; and this gives out 20 candle-power. The area of the pinhole in the last observation was .0063 square centimetre, and gave out 126 candle-power. Hence $\frac{.36}{.0063} \times \frac{126}{20} = 359$, — the intrinsic brilliancy of the sun in terms of the Swan light. The sun therefore radiates 67 times the energy, but 359 times the light, of the Swan lamp, or 5.4 times the light for every horse-power expended.

In May, 1879, the writer conducted some observations on this subject (*Proc. Amer. acad.*, 1880, xv. 236), by which it was found on one occasion that the total brilliancy of the sun, when at an altitude of 25°, was 64,700 candle-power at one metre's distance; and another time, when at an altitude of 40°, 82,000 candle-power. The apparent area of the sun's disc at this distance would be .68 centimetres; and assuming that the area of the candle flame in this instance was 2.7 centimetres, which could not be very

far out of the way, we have the intensity of the light from the sun's disc in the two instances, $\frac{2 \cdot 7}{\cdot 68} \times 64{,}700 = 257{,}000$, and 326,000 instead of 53,000, times that of the candle.

In our author's observation the altitude of the sun could not have been far from 12°; which, together with the greater clearness of the American skies, may have produced the large discrepancies in our results. But assuming my results to be correct, even at an altitude of 40° the sun gives out 33 times the light of a Swan lamp for the same amount of power expended. — W. H. P. [9

(Photography)

Green fog. — A possible explanation of this difficulty is offered by Mr. E. Dunmore, who thinks it is due to the action on carbolic acid by ammonia, converting it into aniline. Both substances are generally present in an emulsion prepared with ammonia; and, with regard to an acid-boiled emulsion, the gelatine may of itself contain them, — the ammonia from incipient decomposition, and the carbolic acid from what has been used to preserve it from putrefaction during manufacture. — (*Brit. journ. phot.*, Dec. 1, 1882.) W. H. P. [10

Cold emulsification. — Mr. A. F. Genlain describes his method of carrying out Mr. Henderson's formula for cold emulsification. He thinks that by discarding the carbonate of ammonia, as Mr. Henderson has since suggested, this will prove one of the most certain processes yet discovered. — (*Brit. journ. phot.*, Dec. 15, 1882.) W. H. P. [11

A modified gelatine emulsion. — Mr. W. K. Burton employs a process by which, in the results obtained, the density of the negative will increase nearly proportionally to the amount of light received. By the ammonia process the density increases too rapidly at first, while in the long boiled emulsion the increase is too slow. But the great advantage which he claims lies in the fact that the gelatine which has gone through the ordeal of the operation necessary to obtain sensitiveness is eliminated. It is this gelatine which he thinks gives rise to many of the evil phenomena which gelatine plates exhibit, especially when ammonia is used. — (*Brit. journ. phot.*, Dec. 15, 1882.) W. H. P. [12

CHEMISTRY.

(General, physical, and inorganic.)

Lecture experiments. — Dr. A. W. Hoffmann has devised a series of lecture experiments similar in principle to those described in his Einleitung in die moderne chemie. The electrolysis and formation of hydrochloric acid are illustrated in a simple manner, and several improvements are introduced into experiments illustrating the phenomena of combustion. Some experiments on the volumetric relations of gases are suggested, and the analysis of ammonia gas is made less tedious in its details. A new form of apparatus is described, which is intended to give an experimental illustration of the law of Dulong and Petit. — (*Berichte deutsch. chem. gesellsch.*, xv. 2656.) C. F. M. [13

Lecture experiments with zinc-dust and sulphur. — In the experiment which is usually performed to illustrate chemical combination, instead of heating sulphur with copper or iron filings, Schwarz makes an intimate mixture of sulphur and zinc-dust, and ignites it with a match. It burns like gunpowder, with a bright greenish flame, leaving a residue of zinc sulphide. When heated in a retort with carbonic disulphide, zinc-dust is converted into the sulphide, and carbon separates in the form of soot. Many complex organic compounds containing sulphur are decomposed when heated with zinc-dust with the formation of zinc sulphide and carbon compounds of a simpler order. — (*Berichte deutsch. chem. gesellsch.*, xv. 2505.) C. F. M. [14

Preparation of oxygen at ordinary temperatures. — When potassium permanganate is mixed with concentrated nitric acid, M. Guyard finds that oxygen is liberated from the permanganic acid with great regularity, and the action continues until two and a half equivalents are set free. If the apparatus is then immersed in boiling water, the disengagement of gas is kept up until altogether three equivalents of oxygen are obtained from the permanganic acid. — (*Bull. soc. chem.*, xxxviii. 383.) C. F. M. [15

The double haloid salts of mercury. — For the purpose of obtaining a more definite knowledge of reactions which take place in the formation of double salts, M. Berthelot has determined the heat of formation of certain double salts of mercury. It appears that the quantity of heat liberated in the formation of the anhydrous salt is smaller than when the hydrous salt is formed: $Hg\,Cl_2 . K\,Cl = +1^{cal.}9$; $Hg\,Cl_2 . K\,Cl . H_2O = +2^{cal.}7$. The acid salt $Hg\,I . 2\,H\,I$. sets free the same amount of heat as the salt $Hg\,I . 2\,K\,I$. While the heat of formation of the three haloid salts of potassium is nearly the same, it is very different in the corresponding salts of mercury: $Hg\,Cl_2 = 11^{cal.}$; $Hg\,Br_2 = 15^{cal.}4$; $Hg\,I_2 = 21^{cal.}7$. This inequality, as the author proposes to show, is the determining cause of double decompositions. — (*Bull. soc. chim.*, xxxviii. 369.) C. F. M. [16

METALLURGY.

New process of manufacturing aluminum. — A mixture of alum and pitch is calcined, retorted, and leached. The residue contains 84 per cent of alumina, while the old process yielded only 65 per cent. The alumina is then made into the chloride; and the chloride is treated with sodium, in the usual way, to obtain the metal. The process has been invented by Mr. James Webster of Holywood, England. — (*Eng. min. journ.*, Dec. 23, 1882.) R. H. R. [17

Fine gold from chlorination. — Gold produced from the mines of the Canada consolidated gold mining company by Mear's chlorination process is reported to be the finest ever received by the U. S. mint. — (*Eng. min. journ.*, Nov. 18, 1882.) R. H. R. [18

Improvements at Batopilas in silver amalgamation. — The losses of 50 oz. per ton in the tails by the old arrastras have been reduced to 8 oz. per ton. The improvements consist of pan amalgamation for the first and second class ore, concentration followed by pan amalgamation for third-class ore. The loss in mercury has been reduced at the same time from 27 per cent, as incurred by the arrastra, to 2½ per cent with the pan. — (*Eng. min. journ.*, Nov. 18, 1882.) R. H. R. [19

GEOLOGY.

Lithology.

Some Himalayan melaphyrs. — Col. C. A. McMahon has made a microscopic examination of certain traps regarding whose origin some doubt had been expressed. The prevailing tendency had been to hold that they were sedimentary rocks metamorphosed; but McMahon holds that his microscopic researches afford abundant proof that they are altered basaltic lavas. Two plates accompany the paper, which indicate either a very low grade of art or a very small appropriation. — (*Rec. geol. surv. India*, 1882, xv. 155.) M. E. W. [20

Rocks classified by formations. — Prof. E. Renevier has published the following classification,

which he regards as a natural one; and, although many will not be disposed to agree with him, it contains certain elements of value.

Deuterogenous rocks.	Clastogenous rocks.	Gravels. Breccias. Conglomerates.
	Psammogenous rocks.	Sand. Sandstone. Quartzite.
	Ilyogenous rocks.	Earthy rocks. Schistose rocks. Lithoidal rocks.
Organogenous rocks.	Zoögenous rocks.	Phanerozoic limestones. Microzoic limestones. Clastozoic limestones. Crypozoic limestones.
	Microntogenous rocks.	Siliceous microntogenous rocks. Ferrugineous microntogenous rocks.
	Phytogenous rocks.	Fossil resins. Bitumens. Fossil carbons. Vegetable earths.
Hydatogenous rocks.	Halogenous rocks.	Saline rocks. Gypseous rocks.
	Crenogenous rocks.	Incrustations. Concretions. Pisolites.
	Phlebogenous rocks.	Quartz, calcite, siderite, barite, fluorite, phosphorite, etc.
Pyrogenous rocks.	Chysiogenous rocks.	Trachytic lavas. Basaltic lavas. Euritic lavas. Dioritic lavas.
	Athrogenous rocks.	Volcanic breccias. Volcanic tuffas.
Crypogenous rocks.	Granitoid rocks.	Granitic rocks. Syenitic rocks.
	Crystalline schists.	Aluminio-alkaline schists. Magnesian schists.

(*Arch. sc. phys. nat.*, 1882, July 15.) M. E. W. [21

Meteorites.

The Dresden meteorites. — A. Purgold gives a list of the forty-five specimens of meteorites in the Dresden museum, adding a brief description of each specimen. Following Tschermak, the meteorites are arranged according to the following classification: —

I. Meteoric stones.
  1. Anorthite and augite. Iron rarely seen. Eukrite.
  2. Olivine, bronzite, enstatite. Iron rarely seen.
  3. Olivine and bronzite with iron. Chondrite.

II. Meteoric iron.
  4. Silicates and meteoric iron forming a granular mixture. Mesosiderite.
  5. Meteoric iron porphyritically enclosing crystals of silicates. Pallasite.
  6. Meteoric iron.

(*Abhandl. gesellsch. Isis*, 1882.) M. E. W. [22

The Pallas iron. — Dr. Stanislas Meunier has made a recent study of a specimen of the celebrated iron olivine meteorite found by Pallas at Krasnjarsk, Siberia. He regards the structure of this meteorite as a vein-form similar to the terrestrial veins commonly known as *filons en cocardes*. The pyrrhotite in this he seems to regard as derived from the nickeliferous iron by the action of sulphuretted hydrogen. On account of this derivation, he claims that this meteorite should be separated from the others enclosed under the pallasites by Gustav Rose. — (*Comptes rendus*, xcv. 938.) M. E. W. [23

Fusion-structures in meteorites. — In this abstract Mr. F. G. Weichmann holds that the supposed organic forms described by Dr. Otto Hahn from meteorites are 'fusion structures,' that is, formed by the cooling of the meteorite from a state of fusion. This view was taken by Prof. Kengott in 1868, when he described these structures in the Knyahinya meteorite, the one in which Hahn found most of his so-called meteoric corals, crinoids, etc. Judging from the abstract, the completed paper of Weichmann will contain much interesting matter. — (*Trans. N. Y. acad. sc.*, 1882, i. 153.) M. E. W. [24

METEOROLOGY.

The hurricane of Oct. 20, 1882. — The observatory of Manila has published a small monograph containing a detailed account of this disastrous storm. It is rare that a storm of this nature passes so near an observatory equipped with self-recording instruments, as in this instance. The centre of the storm moved almost exactly over Manila, which gives this report peculiar value. It contains a chart of the records of the several meteorological instruments, and diagrams illustrating the progress of the hurricane. The observations recorded as the centre of the depression was passing are especially noteworthy. The pressure experienced a rapid fall of 24 millimetres in 3¼ hours, and a correspondingly rapid rise; the temperature rose from 25° to 31° C. in forty-five minutes, and fell with equal rapidity; while the relative humidity dropped from 100 to 53 per cent in the same short time, and rose again. The velocity of the wind, which was 54 metres per second (about 120 miles per hour) immediately before and after the passage of the centre, was 0 for two minutes only before the change of its direction. The diameter of the vortex was about 15 miles, and its velocity of translation 19 miles an hour. — W. U. [25

[An abstract of the Jesuit observations with fuller details and diagrams is given in another part of this week's issue.]

Exposure of thermometers. — Experiments made by Dr. Gill at the Cape of Good Hope, with the Stevenson shelter, Glaisher stand, and a window screen, show large differences in the records of maximum and minimum temperature. An extreme difference of 9.2° is found in the annual value for 1881 of the range between the maximum and minimum readings. Experiments made by Rev. F. W. Stow, with the Stevenson and metallic shelters, favor the latter; but care was not taken to have the shelters of the same size, and the instruments similarly placed within them. There is much need of attention to the subject of uniformity of thermometer exposure, especially in this country. — (*Quart. journ. meteor. soc.*, July, 1882.) W. U. [26

The aurora. — M. Angot considers that the past records of auroral phenomena distinctly indicate diurnal, annual, and secular periods. His researches confirm the electrical theory of the origin of the aurora, as elaborated by Edlund. — (*Lum. électr.*, Dec. 16, 23, 1882.) W. U. [27

PHYSICAL GEOGRAPHY.

Terraces and beaches about Lake Ontario. — J. W. Spencer continues his studies in Canada in the region of the former connection of Lakes Erie and Ontario, and finds evidence of post-glacial lake-submergence 1,700 feet above present sea-level: the Great Lakes must then have been confluent, and connected with the sea by several outlets, — St. Lawrence, Mohawk, southward from Cayuga and Seneca Lakes, and by several paths southward across Ohio. The beaches corresponding to the level of these old outlets are believed to be the most conspicuous and widespread. The 'Artemesia gravel' is regarded as a shore deposit of the subsiding lake. Shore-ice is considered an important agent in building the beaches. — (*Amer. journ. sc.*, Dec., 1882.) W. M. D. [28

High river terraces of eastern Connecticut. — Following the work of Prof. J. D. Dana (*Amer. journ. sc.*, x., 1875, 429), B. F. Koons explains the position of several terraces as depending on ice-dams during the decline of the glacial period. — (*Amer. journ. sc.*, Dec., 1882.) W. M. D. [29

Southward discharge of Lake Winnipeg. — Prof. J. D. Dana decides against Winchell's and Upham's view, that the former southern overflow of Lake Winnipeg was due to a northern ice-barrier; and in favor of Warren's and G. M. Dawson's explanation by a change of level, chiefly a northern depression, because the old lake-shore is no longer level, but slopes to the north with the general slope of the adjoining plateau. — (*Amer. journ. sc.*, Dec., 1882.) W. M. D. [30

Temperature of Wisconsin lakes. — E. M. Gifford and G. W. Peckham found a bottom temperature at 80 ft., of 42° F. through the summer and 39° or lower in the winter. — (*Trans. Wisc. acad.*, v. 273.) W. M. D. [31

GEOGRAPHY.

(*Arctic.*)

Explorations in Alaska. — Drs. Arthur and Aurel Krause of the geographical society of Bremen, who undertook, under the auspices of the society, in 1881, to make explorations in Alaska and the neighborhood of Bering Strait, have returned, and made their preliminary report to the society. In the spring of 1881 they took passage on a small schooner for Bering Strait, and were landed near St. Lawrence Bay on the shores of the Chukchi Peninsula. Here they spent the summer in exploration, returning to San Francisco in autumn, and thence proceeded to Alaska. The winter was spent at a trading-post on Chilkoot Inlet at the head of Lynn Canal, in lat. 59° N., and long. 135° W. Last summer Dr. Aurel Krause returned to Germany, *via* Panama; and in October his brother followed him by way of the line of the Northern Pacific railway. They brought very extensivé collections. A catalogue of the ethnologica has just been issued by the society. The natural-history material has been assigned for study by the director of the Bremen museum as follows: crania, to Prof. Welcker; echinoderms, to Prof. H. Ludwig; fish, to Dr. F. Heincke; decapod crustaceans, to Dr. F. Richters; hydroids and polyzoa, to Herr Kirschenpauer, in Hamburg; reptiles, to Dr. J. G. Fischer; Prof. Metzger takes the amphipods and isopods; Poppe, the copepods; Dr. P. C. Hoek of Leiden, the cirripeds and pycnogonida; Dr. Marenzeller, the annelids; Prof. C. Heller, the tunicates; Dr. F. Karsch, the spiders and myriapods; Dr. W. Peters, the mammals; Director Spängel, the amphibians and zephyreans; Dr. Hartlaub, the birds; Drs. Krause and von Martens, the mollusks; Dr. Aurel Krause, the fossils; while the botanical collections are divided among Drs. F. Kurtz, C. Müller of Halle, Gottsche, and Hagena. Charts of part of the west shore of Bering Strait, of the water-shed between the head of Lynn Canal and the sources of the Yukon, of the East Cape of Asia, and various harbors, have already been issued from plans by the explorers, in the Deutsche geographische blätter. On Nov. 4, Dr. Aurel Krause lectured before the Gesellschaft für erdkunde, Berlin, on the T'linkit Indians of Alaska. The preparation of the final reports will naturally take some time; but the society is to be congratulated on its successful foray in a region so difficult of access, and so distant from the base of operations. — (*Deutsche geogr. blatt.*, v. 4, 1882.) W. H. D. [32

Arctic whalefishery in 1882. — The 'catch' of the Dundee whaling-fleet, eight steamers, amounts to seventy-nine whales, affording about nine tons of blubber each, equivalent to about 5,000 bbls. oil and 100,000 lbs. baleen. Last year, a much more 'open' season, only forty-seven whales were obtained. In the Bering-strait region, the San Francisco fleet obtained a fair reward for their exertions in the form of 21,054 bbls. oil, 313,100 lbs. baleen, and 16,600 lbs. walrus-tusks. The fleet numbers about thirty sail, and the value of the 'catch' reported is about $960,-000. The species pursued in these seas are Balaena mysticetus L. (*bowhead* of the Pacific whalemen, and *right whale* of the North-Atlantic whalers), and B. Sieboldii Gray (known as the Pacific right whale). The whalers resort to 'walrusing' in Bering Strait in default of whales; but in good seasons little walrus-oil is taken, and most of the tusks are purchased by barter from the natives of the region. — W. H. D. [33

(*Africa.*)

German exploration in Africa. — In the past nine years, the German African association has sent six expeditions to the Kongo region, at a total cost of £22,000. The first, under Güssfeldt (1873–76), went to the Loango coast, north of the Kongo. Although not penetrating far into the interior, this trip alone cost £10,500. All the other expeditions entered at S. Paolo de Loanda. Pogge (1875) advanced 700 miles eastward to Kawenda, the chief town of a region as large as Germany, ruled by the Muata Yanvo (king) named Shanama. Mohr died at Malandje, the most advanced Portuguese trading-station, 200 miles from the coast. Schütt (1877–79) reached the Chikapa River, 500 miles inland. Buchner (1879–80) went also as far as Kawenda, staying there six months; and on returning early in 1881, met at Malandje the latest expedition, still in the field, under Pogge and Wissmann. Finding the road to the Muato Yanvo's town (Kawenda) closed on account of his difficulties with the neighboring and aggressive Kioko, Pogge and Wissmann turned north-east, and were last heard from among the Tushilange people, at the towns Mukenge and Kingenge, on the river Ruru (Lulua). They intended going on past Lake Mukamba to Nyangwe, on the Lualawa (Lualaba), lat. 4½° S., long. 26¼° E., whence Wissmann was to proceed to the east coast if possible, and Pogge would return westward. [Wissman arrived at Zanzibar last November.]

The region consists of three physical divisions: the littoral slope, barren and dry, with short rivers running westward; the mountain belt; and the southern part of the Kongo basin, of undulating or hilly surface, well wooded or grassy, cut by very numerous rivers generally running northward, and nearly all with the syllable Lu, Ru, or Ku in their names. This district has a rainy season from September to April, with a temperature from 63° to 81° F. The dry season is occasionally as cool as 45°. The hippopotamus is the only large animal seen; other large game is very scarce. — (*Proc. geogr. soc. Lond.*, Nov., 1882, map.) W. M. D. [34

Upper Senegal and Niger. — Commandant Gallieni was charged by the Governor of Senegal, in 1880, with a mission of exploration in western Soudan, and with powers of treaty to induce the Sultan Ahmadou of Segu to place the Niger within his dominions under French protection. The expedition left St. Louis, Jan. 30, 1880, and began its work of exploration beyond Bafulabe, where the Senegal branches, on March 30 following. Ascending the Ba-khoy branch, the village chiefs accepted French protection; and by Mount Kita a fort was built to serve as an advanced outpost. Here the party divided; Lieut.

Vallière going by Murgula and Kumakhana, and Gallieni crossing eastward to the Ba-ule, to meet again at Bammako on the Niger. Vallière accomplished his journey successfully; but the commandant was attacked at Dio, on May 11, by 1,500 Bambaras, and after a hard fight and heavy loss escaped, leaving his supplies, and joined Vallière as planned. Then crossing to the right bank of the Niger, the whole party descended toward Segu, but were detained at Nango, some leagues from the capital, for ten months, by order of the Sultan. Here they suffered greatly from privation and fever, till at last, concluding a favorable treaty with the Sultan after many *palabras*, they turned back March 21, 1881, returning as Vallière had entered, and reaching St. Louis on May 12. The country was found to be but moderately mountainous: the highest point was by Kumakhana, 750 met., the divide here between the Ba-khoy and Niger being 450 met. The Niger, where followed, was about 300 met. above sea-level. The rainy season lasts from June to December, the rest of the year being dry. Many details are given concerning the best routes for road-construction into the interior. — (*Bull. soc. géogr. Paris*, map.) W. M. D. [35

Expedition to the Kuengo. — This westernmost of the large southern branches of the Kongo has been visited by v. Mechow between lats. 5° and 8° S. He entered and returned by S. Paolo de Loanda. On reaching the river, he descended it to within about 100 miles of its junction with the Kongo, when he was obliged to return by the fear his men felt for supposed cannibals beyond. The river was 1,000 to 1,800 paces broad, enclosed by luxuriant forests in a well-marked valley. Von Mechow returned to Germany early in 1881. — (*Verh. gesellsch. erdk. Berlin*, ix. 1882, 475.) W. M. D. [36

Reported lake west of Albert Nyanza. — Mr. F. Lupton, governor of the Egyptian province Bahr el Ghazal, writes on July 27, 1882, of the reported existence of a great lake, as large as Victoria Nyanza (Ukerewe), about lat. 3° 40′ N., long. 23° E. The Barboa people, living on its eastern shores, are said to make a three-days' voyage across the lake, and obtain from the tribes on the western side beads and wire of European make. Mr. Lupton thinks the Uelle flows into this lake, and that its outlet joins the Kongo. — (*Proc. geogr. soc. Lond.*, Nov., 1882.) W. M. D. [37

BOTANY.

(*Structural and physiological.*)

Chemical character of living protoplasm. — In 1881 Loew and Bokorny published an interesting paper on the effect produced by very dilute solutions of gold and silver on living cells. The protoplasm soon becomes distinctly colored by reduced gold or silver, whereas dead protoplasm gives no such reaction. The present paper by the author first named adds a few details, and attempts a fuller explanation of the phenomena. A single milligram of a salt of silver or gold is dissolved in a litre of water; and the minute object — for instance, a few threads of a filamentous Alga — is placed in the whole amount of liquid. The reactions described by the authors are not seen when the object is treated with the reagents in a more concentrated form, or in a smaller quantity of liquid. Under conditions wholly favorable to the reaction, the protoplasm becomes tinged with faint color in a short time. When, however, a cell containing protoplasm which has been destroyed by chemical or mechanical means is subjected to the same conditions, no change of color is observable. The reaction is assumed to be due to the presence of one or more members of the aldehyde group in the living protoplasm. The authors call attention in their first paper to the singular fact that certain Algae failed to give this reaction. — (*Bot. zeit.*, Dec. 1, 1882.) G. L. G. [38

Some leaf-movements and light. — To express the greater longitudinal growth upon the upper than the lower side of a part, by which the part bends downward, the term epinasty has been used. Detmer, by experiments on germinating plants, has become convinced that the epinastic movements of leaves are wholly dependent on light; and he proposes a new term, photo-epinasty, in part place of the older one. — (*Bot. zeit.*, Nov. 17, 1882.) G. L. G. [39

Epinasty of leaves results, according to E. Mer, from the more rapid development of the palisade cells of the upper surface under the influence of light. — (*Comptes rendus*, Dec. 11, 1882.) G. L. G. [40

Development of pollen in cycads and conifers. — By Jurányi; in part, a reply to Treub of Buitenzorg (Java). The formation of the pollen in Abies and Pinus is almost precisely that of the cycads. — (*Bot. zeit.*, Nov. 24 and Dec. 1, 1882.) G. L. G. [41

Colors of flowers, and light. — According to Schnetzlar, the blue coloring matter in the corolla of Platycodon grandiflorum can be seen to come from the breaking-up of chlorophyl granules pre-existent in the cells. The blue nectaries develop their color even in unopened flowers, and therefore in partial darkness; but the upper part of the ovary becomes blue only in full light. — (*Arch. sc. phys. nat.*, Nov. 15, 1882.) G. L. G. [42

Colors of flowers. — Dr. Müller, in reviewing the subject of floral colors from a biological standpoint, gives abstracts of the contributions to our knowledge of their uses. Readers who confine themselves chiefly to books and papers published in the English language will find that much of what they have been accustomed to treat as original with some of our favorite writers, on the inter-relations between flowers and insects, is here traced to the earlier contributions of German investigators. — (*Kosmos*, 1882, 117.) W. T. [43

Floral forms. — In his 'Across lots,' Mr. Gibson gives us a little pleasantly written philosophizing suggested by the variety in the forms of flowers. — (*Harper's mag.*, Nov., 1882.) W. T. [44

Season of flowering. — Australian acacias, transplanted across the equator into northern India, have been found to gradually adapt their time of flowering to the changed springtime of their new home. For about twenty years, according to Dr. Brandis, no change was noticed; but since it began they have bloomed earlier each successive year until now, twenty years later, they bloom in June instead of October. — (*Indian forester*, 1882.) W. T. [45

(*Systematic.*)

American asclepiads. — Fournier begins an enumeration of the Asclepiadaceae of America, excluding for the most part the United States and Brazil, with notes and descriptions of some new genera and species. — (*Ann. sc. nat.*, 1882, 364.) S. W. [46

Indian species of Primula and Androsace. — Professor G. Watt describes and figures twenty-four species of Primula and six of Androsace from the Himalaya, most of them new or previously undescribed. The paper has undergone revision by Sir J. D. Hooker, and includes notes on the geographical distribution of Primula, remarkable inasmuch as the nearly one hundred species are confined to the temperate and cold regions of the northern hemisphere, with the exception of a single species that abounds in Fuegia and the Falkland Islands. — (*Journ. Linn. soc. Lond.*, Dec., 1882.) S. W. [47

Lythraceae. — Continuation of Koehne's monograph, comprising the genera Decodon, of a single North American species (D. verticillatus, Elliott), Grislea, Adenaria, Tetrataxis, and Ginoria, — the first two perhaps to be united to Heimia, and the last including Antherylium. — (*Engler's bot. jahrb.*, Oct., 1882.) S. W. [48

(*Fossil plants.*)

Heer's Flora fossilis arctica. — The second part of the sixth volume of this celebrated work describes plants of two stages of the cretaceous of Greenland, — those of the schists of Come, referable to the lower cretaceous; those of the schists of Atane, upper cretaceous, including a few species from Pattook, a higher member of the formation of Atane. The publication of the tertiary plants of the same country is reserved for the third part of the volume, the plates being already prepared. All these plants have been described from specimens obtained by the Swedish geographical and geological survey of Greenland under the direction of Steenstrup. And such a degree of attention has been given to paleontological researches by the assistants of the survey, that twenty-five large boxes of specimens of fossil plants were sent to Heer.

The flora of Come, composed of 86 species, has 42 species of ferns, 1 Marsilia, 1 Lycopodium, 3 Equisetaceae, 10 Cycadeae, 21 conifers, 5 monocotyledons, 1 dicotyledon only, and 2 Carpolithes. The flora of Atane, composed of 177 species, has 3 fungi (Hypoxyleae), 34 ferns, 1 Marsilia, 1 Selaginella, 1 Equisetum, 6 Cycadeae, 26 conifers, 8 monocotyledons, and 97 dicotyledons. These two groups of floras of the cretaceous are remarkably different in their composition and in their characters. Besides the great proportional disparity in the number of their representatives, in divers classes of the vegetable kingdom, there is as marked a difference in the characters of the species. While Atane has 97 dicotyledons, Come has only 1, a Populus, represented by a few fragments of leaves; and of the whole number of described species, only 7 ferns, 1 Equisetum and 6 conifers are common to both floras of Come and Atane. This last series of plants shows a greater degree of relation to the flora of the Dakota group: for we find in common to them, 2 ferns, 3 conifers, 1 or 2 cycads, and 8 dicotyledons; and also, the same degree of analogy is remarked in the animal fossil remains found in strata above the schists containing vegetable remains at Atane, and of which some species have been recognized by M. Loriol as identical with those of the Fox Hill group of Hayden, like Avicula nebrascensis Evans, Solemeya subplicata Meek and Hayden, Hemiaster Humphriesianus Meek. — L. L. [49

ZOÖLOGY.

(*Geographical distribution.*)

The Sonoran region. — In continuation of an argument upon the desirability of uniting the nearctic and palearctic zoölogical regions, Prof. Heilprin stated his reasons for separating the Sonoran region (the south-western portion of the United States, and the Mexican state of Sonora) from the rest of North America, and uniting it with the neotropical or South-American region. The reptiles and batrachians, especially of the smaller district, were sharply distinguished from those found to the north and east, and allied to the southern forms.

Dr. Horn stated that the coleopterous fauna of the Sonoran region was, on the contrary, more closely allied to that of the rest of North America. — (*Acad. nat. sc. Philad.; meeting* Jan. 2.) [50

Zoölogical geography of western North America. — Prof. E. D. Cope presented for publication a paper entitled: Notes on the geographical distribution of Batrachia and Reptilia in western North America. The communication is based on collections made by the author and his assistants at various points in the Rocky-Mountain and Pacific regions during the last ten years, and is an important contribution to the final definition of the zoölogical provinces and districts of the continent.

The results to zoölogical geography obtained by the identification of species contained in the collections are as follows: The extension northwards of the range of Crotalus molossus, Stenostoma dulce, Diadophis regalis, Crotalus lepidus, and Holbrookia texana; the extension to the Rocky Mountains of the range of Spea Hammondii; the discovery of a new Scaphiopus in the Great-Basin district; and of the southern extension of Rana pretiosa into the same. It has also been determined that the North-Pacific fauna extends east to the Rocky Mountains. This fauna is especially represented by Bascanion vetustum, Rana pretiosa, and Bufo columbiensis. The Great-Basin district of the Sonoran fauna extends north to the southern slope of the Rocky Mountains in Idaho, where are found several of its species. The same fauna extends north along the eastern slope of the Sierra Nevada, to the beginning of Surprise Valley, California. The North-Pacific fauna extends from Surprise Valley, Eastern California, northwards as far as the author's explorations have extended; viz., to Silver Lake and Klamath Lake. A wide southern range for Spea Hammondi and Bufo columbiensis was also determined.

These results indicate that the Pacific region has much greater extension eastward than has been supposed, although foreshadowed in Mr. Cope's paper on the zoölogy of Montana, published in 1879. They also indicate that the region must be divided into three districts; for which the names Idaho, Willamet, and South-Californian are proposed. The first is characterized by the absence of Gerrhonotus, and of certain species of Amblystoma and Cynops. The South-California is characterized by the presence of Rhinochilus, and absence of Amblystoma. It is allied to the Sonoran region, to which it is adjacent. — (*Acad. nat. sc. Philad.; meeting* Jan. 9.) [51

Protozoa.

Perception of light by low organisms. — Th. W. Engelmann has published some interesting observations on this subject. He maintains that light acts in three fundamentally different manners: 1. Directly, by alteration of the exchange of gases, without demonstrable addition of sensation; 2. Alteration of the sensation of the respiratory needs, consequent upon alteration in the gaseous exchange; 3. By means of a specific process assumably corresponding to our sensation of light. By ingenious arguments he seeks to prove that Navicula is a type of the first, Paramecium bursaria of the second, and Euglena viridis of the third. As regards the last he says that the seat of the perception of light is exclusively in the anterior end of the body, where there is no chlorophyl. — (*Pflüger's arch.*, xxix. 387.) C. S. M. [52

Bütschli's Protozoa. — Parts 14–16 of Bütschli's invaluable revision of the Protozoa in Bronn's Klassen und ordnungen des thierreichs has just appeared. The plates (xxii.–xxviii.) refer to the Radiolaria; the text is entirely devoted to the Gregarinidae, which are nearly completed. It is hardly possible to estimate this work too highly; for there are no other animals concerning which so many errors have been current in recent years as the Protozoa, and it cannot fail to advance zoölogy to have them treated by so

able and competent an investigator as Prof. Bütschli. It is one of the few works that may be fairly termed indispensable to the microscopist and zoölogist. (It is stated from a competent private source that probably two years will be needed to complete the undertaking.) C. S. M. [53

Mollusks.

History and distribution of the fresh-water mussels. — Under this title Dr. R. E. C. Stearns prints a suggestive paper, read before the California academy of sciences, Nov. 20, 1882. The geographical distribution, geological history, and principal subdivisions of the Naiades are summarized, and the species of the great basins and the Pacific slope subsequently taken up in more detail. Anodonta Nuttalliana, representing four nominal species, described twenty-five years ago by Dr. Isaac Lea, from the Wahlámet River of Oregon, has been traced over an immense area, including the drainage system of the Columbia, the valley of California, the lakes of the eastern slope of the Sierra Nevada, thence, either recent or recently fossilized, across the desert to the Wahsatch Mountains, northward to the southern boundary of Idaho and Oregon, along the meridian of 110° W., through part of Montana, to British Columbia, and southward to Fort Yuma. They are found on the surface of the desert, and even, with other still recent species, at a depth of at least fifty feet below the surface. Some of the species have been supposed to be extinct; and in regard to Tryonia, announced by Mr. Tryon in 1873 as found in the living state in Utah by Wheeler's expedition (two specimens), further confirmation seems desirable before it can be confidently claimed as still inhabiting the region. The general uniformity of mollusk-fauna over this region at one time is, however, sufficiently evident. Dr. Stearns traces variations perpetuated by natural selection during the changes brought about in the region by important geological and climatic changes; the radiating distribution from higher altitudes to lower, as the land rose and the waters receded; and the missing links in the chain of migration arising from areal desiccation. He ascribes to the period immediately preceding the glaciation of the higher regions of this area, meteorological conditions more favorable to distribution of aquatic life than any since obtaining there. The author then discusses the circumboreal distribution of four or five species of Limnaea, Physa, etc., and of the fresh-water pearl mussel (Margaritana margaritifera L.), which exhibits some remarkable characteristics in its range. The latter is eaten by the McCloud-River Indians, and by some Oregonian tribes. He concludes, with Wetherby, that the earliest fresh-water forms were lacustrine; and the paper closes with references to the comparative antiquity of Unio and Anodonta, and a list from Lea's synopsis of the number of species of Naiades. — W. H. D. [54

Studies of the Italian cretaceous fossils. — Under the auspices of the Accademia dei lincei, Professor G. Seguenza has just published a valuable memoir on the middle cretaceous formation of southern Italy. Already well known by his valuable contributions to our knowledge of the tertiary strata of the two Sicilies, and especially of Calabria, the present publication can only add to his reputation. The first part discusses the sufficiently simple geology of this formation; the second is devoted to the fauna, which is illustrated by sixteen quarto plates beautifully drawn by the author. Of the 223 species described in this work, 104 are supposed to be new, and 186 are mollusks. There are fish remains of two species, twelve echinoderms (of which nine belong to the genus Hemiaster), and only four corals. Only one brachiopod, a Discina, was collected. Of true mollusks twenty are cephalopods, and fifteen gastropods, leaving, as is evident, the majority lamellibranchiate. In fact, the characteristic feature of the fauna is that it is chiefly composed of bivalve shells belonging to the Veneridae, Veniliidae, Crassatellidae, Cardiidae, Arcidae, and the great heteromyarian group of mussels and oysters. The new genus of Corbulidae (?), Coquandia, is described from internal casts (a condition very general among these fossils), and appears to have somewhat resembled Eucharis Recl., but with the cardinal tooth in each valve prodigiously enlarged, flattened, straight, and set at right angles to the margin. — W. H. D. [55

Insects.

North American Coleoptera. — A record of coleopterology for 1881 and 1882 was presented for publication by F. G. Schaupp. The only foreign descriptions of N. A. beetles were an Oedionychis by Harold, a Triarthron by Schaufuss, a Cymatodera by Gorham, six Elateridae by Candèze, and some fifty Dytiscidae by Sharp. — (*Brookl. ent. soc.; meeting* Jan. 6.) [56

Extension of the theory of mimicry in butterflies. — Mimicry of one butterfly by another widely differing from it in structure was explained by Bates as resulting from some special protection of the mimicked form, as, by distastefulness. Recently some cases have occurred in which both genera involved were similarly protected; and Fritz Müller attempted to explain this by showing how it was advantageous for one species to resemble another which is more abundant in individuals, although both may possess qualities distasteful to those creatures which would otherwise devour them. Distant objects to this extension of the theory; and adduces in support Spalding's experiments upon young turkeys bred in confinement, who showed instinctive alarm of sting-bearing insects. Meldola here comes in, and takes up the question of whether birds have an hereditary distaste for nauseous insects, or learn of their nastiness from sad experience. He claims the latter, while Distant replies in favor of the former view. The discussion partakes somewhat of a polemic character, and is rather barren considering our ignorance of the facts in the case: when they disagree as to which is the mimicking and which the mimicked form, philosophizing is somewhat out of place; yet some suggestions worthy of being kept in mind are made by both parties. — (*Ann. mag. nat. hist.*, Dec., 1882, and Jan., 1883.) [57

A carnivorous bee. — P. Parfitt captured on the wing a male Halictus with its mouth full of insects; viz., a fly, a larval homopteron, and several plant-lice. — (*Ent. monthl. mag.*, No. 223.) [58

VERTEBRATES.

Origin of the hypoglossus and morphology of the head. — Perhaps the most interesting and important discovery in embryology made recently is that of the nature of the hypoglossal nerve by Dr. August Froriep. This investigator found, in ruminant embryos, evidences of three distinct proto-vertebrae in front of the first spinal or cervical nerve, and behind the vagus. In front of each of these is a distinct set of anterior nerve roots, which all unite into a single trunk, — the hypoglossus. Over the posterior of these sets of roots is a dorsal ganglion, which also unites with the same nerve, and resembles the spinal ganglia in position and shape, although smaller in

size. The hypoglossus must therefore be considered to have been formed by the fusion of at least three spinal nerves. As is well known, it makes its exit through the occipital bone, which must therefore be regarded as formed by the fusion of several vertebrae. This, again, forces us to the conclusion that the skull is not identically composed in all animals, but that in the mammals portions of the primitive cervical region have been added to the head, the portions thus added being the hypoglossal region.

At present, therefore, we must consider the head as made up, in mammals, of three divisions: 1°, the prepituitary or trabecular region, bearing the nose and eyes, and corresponding to the upper face; 2°, the pseudo-vertebral region, which gives off the nerves, namely, trigeminal, facial, glosso-pharyngeal, and vagus, supplying the visceral arches or pharyngeal clefts. (The vagus, as is well known, is supposed to be the product of the fusion of several nerves.) 3°, the vertebral region, that of the occipital bone and hypoglossal nerve. This is an entirely new start in the interpretation of the morphology of the head.

The ganglion of the hypoglossus is not permanent. It is always smaller than the spinal ganglia, but for a while it enlarges with the growth of the embryo; it then remains stationary, and becomes finally atrophied. Dr. Froriep's clear and concise presentation of his subject, and his philosophic grasp of its far-reaching conclusions, as well as his modest tone, deserve high praise. His short article should be familiar to every morphologist. His observations were made principally on sheep embryos, and by means of longitudinal sections. Embryos of from 8 to about 18 mm. long show the development of the hypoglossus. — (*Arch. anat. physiol., anat. abtheil.* 1882, 279) C. S. M. [59

Origin of the vertebrates. — Mr. C. O. Whitman described a rare form of the blastoderm of the chick, in which the primitive groove extended to the very margin of the blastoderm, terminating here in the marginal notch first observed by Pander. The blastoderm was eighteen hours old, and nearly one centimetre in diameter. The extension of the primitive groove to the marginal notch was regarded as a reappearance of a developmental feature, which is constant in some of the lower vertebrates and their nearest invertebrate allies, but which has ceased to be a normal occurrence in the development of the chick. The blastoderm, interpreted as an atavistic form, was held to be an important confirmation of the theory put forward by His and Rauber, according to which the vertebrate embryo arises by concrescence of the two lateral halves of the germ-ring. The objections made to this theory by Balfour were reviewed, with a view to showing that they presented no serious difficulties to the acceptance of the concrescence theory. Mr. Whitman maintained that Balfour's objections were not broad enough to cover his own theory of the origin of the vertebrates from annelids, — a theory which gave us a right to expect some fundamental agreement in their modes of development. This agreement, he contended, was seen, first, *in the origin of the embryo from a germ-ring, by the coalescence of the two halves along the axial line of the future animal*; and, secondly, *in the metameric division*, which followed in the wake of the concrescence. The theory of the annelid origin of the vertebrates was inconsistent with the denial of the concrescence theory, since concrescence of the germ-bands is a well-established fact for both chaetopods and leeches. The theory of differentiation set up by Balfour in opposition to that of concrescence entirely ignored the annelids, and offered no explanation of the uniform relations of the embryo to the germ-ring. — (*Bost. soc. nat. hist.; meeting* Jan. 3.) [60

Fish.

Use of the saw in Pristis. — In presenting the beak of a saw-fish (Pristis) from the Lake of Bay, Philippine Islands, Dr. S. Kneeland suggested a use for this toothed projection, in this specimen thirty-three inches long, which seems more reasonable than the ones usually given; viz., that it is an instrument for more or less horizontal insertion in the mud or sand of shallow waters, which, by a vigorous sweep of the long upper-lobed, shark-like tail, is quickly pulled out backward. The lateral teeth are sharp-edged in front for easy insertion, but concave behind to offer resistance, and more thoroughly stir up the bottom; this action is doubtless accompanied by a series of short horizontal movements of the anterior part of the body. The mouth is small, underneath, with pavement-like teeth, as in the rays, adapted for crushing the mollusks, crustaceans, and hard-cased creatures on which it feeds. He thinks the stories of its attacking in open sea the smaller cetaceans are errors of observation, arising from confounding the saw-fish with the sword-fish (Xiphias); neither its weapon, its mouth, its teeth, its habitat, nor its habits, can be reconciled with the active carnivorous propensities ordinarily ascribed to it. Ray-like, it is a bottom feeder, with crushing and not tearing teeth: the snout is too blunt for piercing, and its lateral teeth would be an impediment rather than an advantage. — (*Bost. soc. nat. hist.; meeting* Jan. 3.) [61

Digestion in fishes. — Charles Richet finds in cartilaginous fishes of the genera Scyllium and Acanthias, that the gastric secretion is extremely acid and contains pepsin. This pepsin differs from that of the warm-blooded animal in that it acts as well at 20° C. as 40° C., and for its best activity needs a much more acid medium. There is no trypsin in the gastric secretion, though this has been found in other fishes. As regards the pancreas, Richet comes to direct issue with Krukenberg, who states its secretion in these fishes contains trypsin but no amylolytic ferment. — (*Archiv. de physiol.*, x. 1882.) H. N. M. [62

Reptiles.

Fangs of the rattlesnake. — Dr. Leidy exhibited a series of fangs obtained from a rattlesnake fifty-two inches in length. The rapidity with which the functional fangs are reproduced was indicated by the presence, on each side of the jaw, of five fangs in varying degree of development, so placed as to replace those which are lost. — (*Acad. nat. sc. Philad.; meeting* Jan. 2.) [63

Birds.

An hermaphrodite bird. — The subject of this paper by Mr. Jeffries is a green-tailed towhee from Colorado. On dissection the bird was found to possess a normal ovary and duct on the left side, and a normal testicle and vas deferens on the right side. Owing to the early time of capture, and to insufficient means of preservation, the presence or absence of spermatozoa could not be affirmed. The kidneys of the bird showed slight anomalies. The plumage was that of a female. — (*Bull. Nutt. ornith. club*, viii. No. 1.) J. A. J. [64

Peculiar air-sacs. — M. Boulart has found a pair of air-sacs which lie on the sides of the neck, and communicate with the nasal cavity, in Leptoptilus cruminiferus, Ciconia alba, Mycteria australis, and Sula bassana. In these cases there is no communication with the air-sacs supplied by the lungs. In

a species of hornbill, similar sacs are found, but in communication with the lungs, — sacs supposed to be filled by strong expiration, and resultant increase of pressure in nasal cavity. — (*Journ. de l'anat. physiol.*, No. 5, 1882.) J. A. J. [65

Mammals.

Measurement of the quantity of blood in living mammals. — For this purpose Gréhant and Quinquaud employ a method which essentially consists in letting the animal for some time respire a gaseous mixture containing a known and not fatal proportion of carbon-monoxide. At the end of the time the residual gas is analyzed, in order to find the amount of carbon-monoxide which has been absorbed. A specimen of blood is also drawn from the animal, and the quantity of carbon-monoxide in it determined. The ratio of this quantity to the total amount of the gas absorbed is then assumed to be the ratio to the whole blood of the quantity of blood from which the gas was extracted. Their results as to the quantity of blood in the body agree closely with those of previous workers. — (*Journ. de l'anat. physiol.*, 1882, No. 6.) H. N. M. [66

Histology of the pancreas. — In the transactions of the university of Kieff, vols. xi. and xii., for 1881, and vol. i., 1882, W. Podwyssotzki, jun., published an extensive Russian memoir on the structure of the pancreas. The research was carried out in Peremeschko's laboratory at Kieff. The author has just published a German abstract. The secretory cells consist of two zones: a peripheral, with all the characteristics of an albuminoid body, and a central granular zone. In the cavity of the alveoli, the ducts, and the fluid of the gland, the granules are wanting. The granules of the central zone are not pure albuminoids, nor identical with the usual granules of protoplasm; they may be considered the material substratum of the trypsinogen or pancreatic zymogen. The intracellular network (Ebner, Boll) does not exist during life, there being a fluid intercellular substance which may be coagulated like a network by hardening agents. The intercellular spaces are connected with the secretion probably by receiving the transuded fluids from the capillaries. There are peculiar branching, anastomosing, wedge-shaped, connective tissue corpuscles inside the *membrana propria*. The *plate*-shaped processes of the centro-acinary cells extend into the intercellular spaces. Both these and the wedge-shaped cells are metamorphosed connective (not epithelial) cells of the finest ducts. The intercellular fissures, as far as the processes of the centro-acinary cells extend, are the anatomical beginnings of the ducts, which do not therefore arise in special canals or capillaries (Gianuzzi, Savioti). The *membrana propria* is composed of connective fibres, forming a thick and fine network, and contains no cells or nuclei, and sends no processes into the interior of the alveoli. — (*Arch. mikr. anat.*, xxi. 765.) C. S. M. [67

Abnormal dentition in dog and man. — Mr. Jacob Wortman called attention to the presence of a third true molar in the upper jaw of a skull of Canis lupus from Sweden. He considered it a case of partial reversion to a more generalized type, such as Amphicyon, where three molars exist both in the upper and lower jaw, and believed that it furnished a hint as to the probable origin of the genus Canis.

Dr. J. Leidy described a case of abnormal dental development in an adult man. Although the jaws were well formed, they contained only one incisor, one canine, two premolars, and one molar, on each side. Usually when a tooth is absent, and there is no evidence of its having been extracted or lost, it has probably been retained embedded in the jaw; but in the case described no germs of the lacking teeth existed. — (*Acad. nat. sc. Philad.; meeting* Jan. 9.) [68

Anatomy of the Aeluroidea. — St. George Mivart occupies sixty pages with notes on this group, in support of the classification proposed by him in a former memoir. The osteology is dwelt upon at length, and two very extended tables of skeletal proportions are given. — (*Proc. zoöl. soc. Lond.*, 1882, 459.) F. W. T. [69

A monstrous orang. — W. A. Forbes describes an abnormal Pithecia satanas, having the third and fourth digits of both mani webbed to the tips. — (*Proc. zoöl. soc. Lond.*, 1882, 442.) F. W. T. [70

Direct communication between the median vaginal cul-de-sac and uro-genital canal in marsupials after parturition. — J. J. Fletcher found such communication in two nearly adult females of Osphranter robustus, five of Halmaturus ruficollis, and nine of Petrogale penicillatus. In two small specimens of O. robustus and two of P. penicillatus it did not exist. — (*Proc. Linn. soc. N. S. Wales*, vi. 1882, 796.) F. W. T. [71

Mammals of north-eastern New York. — Dr. Merriam enumerates 42 species of mammals for the Adirondack region, including Phoca vitulina, and gives many original notes on the habits of fifteen carnivores. — (*Trans. Linn. soc. New York*, i. 1882, 27.) F. W. T. [72

PHYSIOLOGICAL PSYCHOLOGY.

The time of apperceiving simple and compound concepts. — With the eyes of the observer directed into a dark chamber toward a Geissler tube, the time from the electric illumination of the tube to the instant of closing a key was measured by Dr. M. Friedrich for four observers as the simple reaction time; the additional time required to distinguish colors in this light, to read figures and determine the number of dots irregularly disposed, was then measured. It was found that numbers of two and three figures were apperceived quicker than those of one or four or more, a notable increase of time being required to apperceive the fourth figure. If, however, the first two figures were 18, they were more quickly perceived than any others, being more familiar as designating the present century. — (*Philos. studien*, i. 1.) G. S. H. [73

Psychological methods. — W. Wundt gives the following: 1°. The psycho-physic method, the accuracy of which has lately been questioned, but which Wundt concludes to be valid, save when applied by averaging right and wrong cases, where more thorough tests than Fechner or any of his successors have applied are needed. 2°. The method of analysis of sense-perceptions is made to include (*a*) composition, e.g., Helmholtz's combination of simple tones into timbre; (*b*) decomposition, e.g., Weber's space-threshold; (*c*) variation, e.g., stereoscope, judgment of broken and unbroken lines. 3°. Method of measurement of psychologic time, by reaction, comparison, reproduction, and complication. — (*Philos. studien*, i. 2.) G. S. H. [74

The time-sense. — Two metronomes were allowed by J. Kellert to tick twice, one after the other. The pendulum of one remaining constant, that of the other was then gradually lengthened or shortened till the observer noted a difference in the interval between the ticks of the latter and those of the

former. Seven intervals of the normal metronome from 0.4 to 1.5 seconds were studied. The result showed that the indifference point at which the judgment accorded most accurately with the time of sensation was 0.755 seconds. Intervals less than this were overestimated, those greater than it underestimated. — (*Philos. studien*, ii. 1.) G. S. H. [75

EARLY INSTITUTIONS.

Universities. — On taking the rectorship of the University of Greifswald, Professor Dr. Behrend describes briefly the beginning and growth of universities: the origin of different faculties (medicine, from Salerno; law, from Bologna; theology and philosophy, from Paris); constitutions; relation with the state, and so on. — (*Deutsche rundschau*, Dec., 1882.) D. W. R. [76

English surnames. — Dr. Beddoe, F.R.S., considers them from an ethnological point of view. Large proportion of Norman names among the peers; Saxon names among the small land-owners and yeomen; nothing like a complete amalgamation of blood between the upper and lower classes. Probably a tenth of the inhabitants of the British Isles bear names of the Celtic-Irish type. Several other conclusions are reached. — (*Journ. anthrop. inst.*, xii. 2.) D. W. R. [77

Agrarian institutions. — Professor Hanssen continues his studies of land-holding and agriculture among the early Germans. Certain heads of families joined together in clearing a tract of land. Upon this they took house-lots (permanent holdings) and arable lots (shifted from one part of the clearing to another, according to the field-grass system). The house-lots were held in severalty, the rest of the land in equal, but undivided shares. This was the primitive agricultural community. It is assumed by Professor Hanssen to have been an association of land-owners. We would suggest that it is an open question whether it was an association of land-owners, or an association of tenants. — (*Zeitsch. gesammt. staatsw.*, 1882, 3, 4.) D. W. R. [78

Medieval formulae. — The "Monumenta Germaniae historica. Leges V. Formulae. Pars pria. 4to. 1882," has appeared. — D. W. R. [79

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Smithsonian institution.

Telegraphic announcements of astronomical discoveries. — Arrangements having been completed with the director of the Harvard college observatory for conducting the system of telegraphic announcements of astronomical discoveries, which was established by this institution in 1873, correspondents are informed that hereafter the American centre of reception and distribution of such announcements will be the Harvard college observatory, Cambridge, Mass., to which address all astronomical telegrams should in future be sent. It is hoped and believed that this transfer of a highly important service will prove beneficial to the interests of astronomical science.

National museum.

The museum cases and stands have been recently examined, with a view to adoption, by gentlemen from Richmond college, Cornell university, and the museum of hygiene connected with the United States navy.

Recent additions. — A large collection of remains of the Arctic sea-cow (Rhytina gigas), including eleven skulls more or less perfect, has been recently received from Dr. Leonard Steineger, collector for the Smithsonian institution, at Bering Island. The specimens were accompanied by two skulls of ziphioid whales, and some valuable bird-skins. Nineteen car-loads of specimens have been received from the late Permanent exhibition in Philadelphia.

Cast of a whale. — A cast of a humpback whale has just been completed. It represents a young female, 32 feet 5 inches long, which was captured at Provincetown, Mass., about three years ago. The cast shows one-half the exterior. In the concavity, which is painted black, the skeleton is mounted in its natural position. The work has been done by Mr. Joseph Palmer.

Preparation for the fisheries exhibition. — A large number of objects have been added to the collection illustrating the fisheries, for exhibition in London in April. A model of an undisturbed oyster-bank and of one overdredged are being prepared under the supervision of Lieut. Winslow. One of the museum preparators is in New Haven, engaged in making, under the direction of Mr. Emerton of Yale College, a model of a giant squid. Five relief-models, representing the entire Atlantic coast of the United States, are in course of preparation by the U. S. coast survey, at the expense of the U. S. fish commission. Those representing the Gulf of Maine and the Gulf of Mexico are completed. The latter was exhibited by Professor Hilgard at the recent meeting of the National academy. The isobathic lines are shown in the same manner as the contour lines of the geological relief-maps. The models are prepared by Mr. C. Lindenkohl. Mr. Henry W. Elliott and Capt. J. W. Collins have prepared a series of drawings of fishing-vessels in action. They are probably the most accurate drawings of this nature ever produced, and are worthy of study by artists engaged on marine subjects. The Light-house board and Life-saving service will make a full display of their apparatus.

Model of Zuñi. — An accurate model of the pueblo of Zuñi has recently been completed for the Bureau of ethnology under the superintendence of Mr. Victor Mindeleff. It is about 19 × 11 feet square, and shows the details of the houses and streets. The data for its construction were derived from actual surveys.

Archeological fraud. — A remarkable archeological fraud in the form of a stone idol arrived at the museum a few days ago. It had been advertised as probably the 'god of all the gods.' It has the beak of a bird, the forehead of a lizard, the wings of a beetle, and the abdomen of a grasshopper. The feet are six in number, — four like those of a gopher tortoise, two like those of a seal. The general color is brown, relieved here and there with lighter spots and streaks. The length of the object is about 2¼ feet, the width about 6 inches.

Department of agriculture.

Extension of statistical division. — The scope of the statistical division was last year enlarged to include in its monthly reports statements showing the through rates of transportation by railroad and steamboat companies, on all the principal routes of the country, for the principal agricultural products.

A European agency was also established for the collection of statistics indicating the prospective European demand for American grains and meats. The agency is in charge of Mr. Edmund J. Moffatt, and its headquarters are at the office of the consul-general at London. The results of this widening of the scope of the statistical division have already proved highly satisfactory.

Meeting of agriculturists. — Commissioner Loring has issued another call for a series of meetings of prominent agriculturists at the department at Washington, commencing Jan. 23. The subjects announced for discussion were: agricultural colleges and their work, the animal industries of the country, and the cotton crop and its relation to agriculture in the cotton States.

National experiment stations. — A bill is now before Congress, introduced by Representative Carpenter of Iowa, providing for the establishment of national experiment stations in connection with the agricultural colleges of the different States, and under the control of the department. An annual appropriation of $15,000 for each station is provided for, to be expended in salaries and the expenses of experiments. The bill has received the indorsement of Commissioner Loring, and is considered the soundest and most practical scheme in the way of agricultural legislation which has been brought before Congress since the agricultural college land grant of 1862. Small as the appropriation is, it will give a much-needed stimulus to the work of some of our smaller agricultural colleges, especially in the south.

Sorghum. — Since 1877, the efforts of the department to prove the possibility of profitable sugar-making from sorghum have attracted much attention throughout the country, and been variously commented on by the agricultural press. Some time since, the results of the investigations of Professor Collier, chemist of the department, were submitted to the National academy of sciences for an opinion as to their value. The report of the committee of the academy, first made, was withdrawn for revision on the 21st of last July, and returned to the commissioner on the 15th of November, when an abstract was given to the daily press. The entire report will be published as a special document. Realizing the fact that the results of the mill-work at Washington during the two previous years had been discouraging, Dr. Loring devoted the congressional appropriation for the continuance of experiments in 1883 to the remuneration of the successful manufacturers throughout the country, for operations conducted under his direction. In this way a great amount of practical experience from different sections has been obtained, and will soon be published in a special report. This course was heartily indorsed by the Cane-growers' association of the Mississippi valley at its recent annual meeting in St. Louis, and before which the commissioner delivered an address, in which he reviewed the whole subject of sorghum sugar-making, and urged that the effort to establish so important an industry as the production of sugar in the Northern States should be conducted with the same judgment, patience, and perseverance as have been applied to the great industries already established.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoölogy, Cambridge, Mass.

Selections from embryological monographs. — One of the last numbers of the memoirs of the museum contains the first of a series of Selections from embryological monographs, compiled by Alexander Agassiz, Walter Faxon, and E. L. Mark. The object of these selections is to give to the student in an easily accessible form a more or less complete iconography of the embryology of each group of the animal kingdom. This selection is not intended as a handbook, but rather as an atlas to accompany any general work on the subject. The plates will be issued in parts, each part covering a somewhat limited field. The quarto illustrations are accompanied by a carefully prepared explanation of the plates, and by a bibliography in octavo, to be made as complete as possible.

The first part, Crustacea, is by Mr. Faxon. It consists of fourteen plates and twenty-eight pages of explanatory matter. The source from which each figure is taken is invariably indicated, while a general heading for the principal groups treated gives a list of the authors whose figures have been copied. A number of unpublished original drawings by Mr. Agassiz have been incorporated wherever they supplement published material.

We may form some idea of the activity of the different nations in the field of morphology by stating that these illustrations were copied from the memoirs of nine Germans, five Americans, four Russians and as many English, of three Scandinavians, two Belgians, one Dutchman, and one Frenchman; the importance of the contributions is also fairly represented in the above enumeration.

Dr. A. S. Packard, jun., and Dr. J. W. Fewkes, will assist the editors of the 'selections' in the preparation of the Insects and Acalephae. The second number of the bibliography, Echinodermata, by Alexander Agassiz, has been issued as No. 2 of vol. x. of the museum bulletin; the illustrations of that part will be published during the coming summer.

Academy of natural sciences, Philadelphia, Penn.

The Vaux gift. — Arrangements are being made for the reception and arrangement of the fine collections of minerals and antiquities belonging to the late William S. Vaux. The gift includes a sufficient endowment to provide for the appointment of a special curator and for the annual increase of both collections by purchase of specimens.

Professor A. Heilprin began a course of twenty-five lectures on physiography and paleontology, on Jan. 12, to be given on the successive Tuesdays and Fridays of each week. The lectures involve the consideration of the following general subjects: The rock masses of the earth's crust; present and past climates; wind and currents; geographical and geological distribution of animals; and the succession of life on the globe.

At the close of Professor Heilprin's lectures, Professor H. Carvill Lewis will deliver a course on mineralogy and lithology, a large portion of which will consist of a series of field-lectures upon the mineralogy and lithology of Philadelphia and vicinity, of which a fuller account will be given in a future issue. Similar courses delivered last year by Professors Heilprin and Lewis were well attended, principally by teachers in the colleges and higher schools of the city.

NOTES AND NEWS.

— A telegram from London, Jan. 17, informs us that Mr. George H. Darwin has been elected professor of astronomy and experimental philosophy in the University of Cambridge. Professor Darwin is a son of the late Charles R. Darwin, and, until very recently, has been a Fellow of Trinity College. Al-

though a young man, he has been for several years a Fellow of the Royal society, and has attained a world-wide reputation for his investigations in celestial mechanics.

Professor Darwin's more important papers are: On the influence of geological changes in the earth's axis of rotation; — On the bodily tides of viscous and semi-elastic spheroids, etc.; — On the precession of a viscous spheroid, etc.; — Problems connected with the tides of a viscous spheroid; — On the tidal friction of a planet attended by several satellites, etc.; — On the secular changes in the elements of the orbit of a satellite, etc.; — On the stresses caused in the interior of the earth by the weight of continents and mountains. These papers are all contained in the Philosophical transactions of the Royal society between the years 1876–82. Professor Darwin has also published many other papers on the above and cognate subjects, which are to be found in various scientific publications. One of his latest papers is the Report of the British association committee appointed for the measurement of the lunar disturbance of gravity; and on another page of this issue will be found a full analysis of a still more recent essay.

Professor Darwin's friends, both in America and England, must feel that the University of Cambridge has honored itself as much as it has honored him in appointing him to this high position, as his scientific ability and acquirements in the particular line of work to which he has chosen to devote himself rank second to those of no one living. American students who have had the pleasure of meeting Professor Darwin in Cambridge cannot help feeling a decided pleasure in hearing of his elevation when they recall his uniform kindness and generous hospitality.

— We regret to announce the death of the Rev. Titus Coan, whose contributions to our knowledge of the volcanic outbreaks of Mauna Loa are well known. Born at Killingworth, Conn., in 1801, he was sent in 1833 by the American board of commissioners for foreign missions to explore Patagonia, and, in the next year, as a missionary to the Hawaiian Islands, where for nearly half a century he has been a faithful and beloved pastor. In his mission district on Hawaii is the largest active volcano in the world; and its two craters, Mokuaweoweo and Kilauea, were carefully watched and studied by him. The wild path of his quarterly tours led along the brink of Kilauea, and no man knew more of its condition than he. From the flanks of Mauna Loa came many important lava-flows; the latest, in 1881, after a course of more than thirty miles, came within a mile of his doorway; earthquakes rocked his house in Hilo; sea-quake waves swept his shores; landslides destroyed his people and their cattle. In the midst of these phenomena he carefully observed and recorded; and his reports published in various scientific periodicals (especially in the American journal of science), as well as in the Missionary herald, contain most vivid and accurate accounts of Hawaiian volcanic action. Every explorer of these islands has been welcomed to his beautiful home, and greatly assisted; and all have parted from him as from a wise and good friend they hoped again to meet. Healthful all his life, he died of old age on the 1st of last December. His Adventures in Patagonia, published a few years since, and his Life in Hawaii, 1835–1881, contain the modest story of his life, at once wise, useful, philanthropic, and religious. A memorial meeting was to be held at Hilo, on his birthday, Feb. 1.

— The annual election of the Academy of natural sciences of Philadelphia was held on Dec. 26 last, and resulted as follows: President, Jos. Leidy, M.D.; Vice-Presidents, Thomas Meehan and Rev. Henry C. McCook; Recording Secretary and Librarian, Edw. J. Nolan, M.D.; Corresponding Secretary, George H. Horn, M.D.; Treasurer, William C. Henszey; Curators, Jos. Leidy, M.D., Charles F. Parker, Jacob Binder, and W. S. W. Ruschenberger, M.D.; Councillors to serve three years, Thomas A. Robinson, Edw. Potts, Isaac C. Martindale, Theo. D. Rand.

The annual reports of the officers and sections, which were read, indicated that the society, during the past year, has been in a condition of unusual prosperity.

— The Anthropological society of Washington held its annual election Jan. 16, with the following result: President, Col. Garrick Mallery, U.S.A.; Vice-presidents, Dr. Robert Fletcher, President J. C. Welling, Major J. W. Powell, and Professor Otis T. Mason; General Secretary, Dr. W. J. Hoffman; Corresponding Secretary, Col. F. A. Seely; Treasurer, Professor J. Howard Gore; Curator, Col. C. C. Royce; Council at large, Professor L. F. Ward, Mr. G. K. Gilbert, Dr. A. F. A. King, Professor E. A. Fay, Mr. H. W. Henshaw, and Mr. David Hutcheson. Major Powell retires from the presidency after four years service.

— At its general meeting, Jan. 6, the Brooklyn entomological society elected the Rev. G. D. Hulst, president; F. G. Schaupp, secretary; Charles Fuchs, treasurer; and J. B. Smith, curator.

— The young folks' course of four scientific lectures, given in Washington at the National museum, under the auspices of the biological and anthropological societies, was successfully brought to a conclusion on Jan. 6. The attendance throughout was good. It was the first course of the kind attempted in Washington for many years.

The second course of free Saturday lectures, inaugurated last year under the same auspices, was opened on the 13th inst. Twelve lectures will be given. The schedule for the first half of the course is as follows: —

Jan. 13, Capt. Clarence E. Dutton U. S. A., On rivers; Jan. 20, Professor Otis T. Mason, The races of men; Jan. 27, Mr. George Kennan, Mountains

and mountaineers of the Caucasus; Feb. 3, Dr. D. Webster Prentiss, Mesmerism in animals, with experiments; Feb. 10, Professor Theodore Gill, Mythical animals; Feb. 17, Dr. John S. Billings, U.S.A., Germs and epidemics.

— At the meeting of the Biological society of Washington, held Jan. 19, an address was given by the retiring president, Professor Theodore Gill, on the Principles of zoögeography.

— The Association of Ohio Colleges, during its meeting at Wooster, Dec. 27, formally adopted the resolutions of the American association for the advancement of science and the American philological association, concerning the degrees of S.D. and Ph.D. Henceforth the sixteen colleges comprising the association are in honor bound not to confer either degree, except upon examination.

— Diffuse but entertaining notes on the habits of Lepus sylvaticus are given by Rev. Samuel Lockwood in the December number of the American Naturalist.

RECENT BOOKS AND PAMPHLETS.

Ballard, R. The solution of the pyramid problem, or Pyramid discoveries; with a new theory as to their ancient use. N.Y. 1882. 8°.

Beal, W. J. The new botany: a lecture on the best method of teaching the science. *2d ed., revised.* Phila., *Marot.* 1882. 16 p. 8°.

Beard, George M. Herbert Spencer on American nervousness: a scientific coincidence. N.Y., *Putnam.* 1883. 17 p. 8°.

Brunner von Wattenwyl, Carl. Prodromus der europäischen orthopteren. Leipzig, *Engelmann.* 1882. 32 + 466 p., 11 pl., map. 8°.

Cambridge — Peabody museum of American archæology and ethnology. Fifteenth annual report of the trustees [and curator]. Cambridge, *Trustees.* 1882. [106 p.] 8°. Forms vol. iii., No. 2, of the reports.

Comstock, J. H. Report on insects for the year 1881; with illustrations. Wash., *Government.* 1882. 22 p., [7] pl. 8°.

Dames, W., *and* **Kayser**, E., *editors.* Palæontologische abhandlungen. 1er bd. heft. 1. Struckmann, C. Neue beiträge zur kenntniss des oberen Jura und der waeldenbildungen der umgegend von Hannover.) Berlin, 1882. 4 pl. 4°.

Decante, E. Tables du cadran solaire azimutal pour tous les points situés entre les cercles polaires. Variation automatique, détermination instantanée du relèvement vrai, controle de la route. 2 vol. Paris. 1882. 8°.

Fletcher, Robert. On prehistoric trephining and cranial amulets. Wash., *Government.* 1882. 32 p., 9 pl. 4°.

Frayer, Persifor. Mémoire sur la géologie de la partie sud-est de la Pennsylvanie. Thèse présentée à la faculté des sciences de Lille. Lille, *Imp. Six-Horemans.* 1882. 179 p., 4 pl. 4°.

Geikie, Archibald. Text-book of geology. N.Y. *Macmillan.* 1882. 11+971 p. *ill.* 8°.

Harris, Edward Doubleday. Memoir of Thaddeus William Harris, M.D. Cambridge, *Wilson.* 14 p., chart. 8°.

Hoffer, E. Die hummeln Steiermarks. Lebensgeschichte und beschreibung derselben. i. hälfte. Graz. 1882. 8°. Plates.

International exhibition of electricity, Paris, 1881. Report of the sub-commission [Barker *and others*] on incandescent lamps. N.Y., *Burgoyne pr.* 1882. 28 p. 8°.

Laflamme, *l'abbe* J. C. K. Le Canada d'autrefois; esquisse géologique. Conférence donnée à l'Institut canadien de Quebec, durant l'hiver de 1882. *n.p.* 23 p. 8°.

Loew, O., u. **Bokorny**, T. Die chemische kraftquelle im lebenden protoplasma; theoretisch begründet und experimentell nachgewiesen. München. 1882. 8°.

London — Royal geographical society. Supplementary papers. Vol. i. pt. 1. (Travels and researches in western China; by E. C. Baber.) London. 1882. 8°.

Mass. — Commissioners on inland fisheries. Seventeenth annual report for 1882. Boston, *State.* 1883. 58 p. 8°.

Maxwell, James Clerk. Life, with selections from his correspondence and occasional writings, and a sketch of his contributions to science; by Lewis Campbell and W. Garnett. N.Y., *Macmillan.* 1882. 16+662 p., 3 portr. & pl. 8°.

Minchin, G. M. Uniplanar kinematics of solids and fluids, with applications to the distribution and flow of electricity. N.Y., *Macmillan.* 1882. 8+266 p. 12°.

Princeton — College of New Jersey. Preliminary report upon the Princeton scientific expedition of 1882; by W. B. Scott and W. F. Magie. Princeton, *Robinson, pr.* 1882. 8 p. 8°.

Riley, C. V. Report of the entomologist of the Department of agriculture for the year ending June, 1882. Wash., *Government.* 1882. 167 p., 20 pl. 8°.

Scientific and literary gossip. Vol. 1, nos. 1–3. Boston, *Cassino.* 1882–1883. 16 p.*m.* 8°.

Searles, W. H. Field engineering: a handbook of the theory and practice of railway surveying, location and construction. *4th ed.* N.Y., *Wiley.* 1883. 12°.

Searles, W. H. The railroad spiral: the theory of the compound transition curve reduced to practical formulæ and rules for application in field-work. N.Y., *Wiley.* 1883. 12°.

Southwick, A. P. Question-book of botany with notes, queries, etc. Syracuse, *Bardeen.* 1882. 40 p. 16°.

Spencer, Herbert. Herbert Spencer on the Americans and the Americans on Herbert Spencer: a full report of his interview and of the proceedings at the farewell banquet of Nov. 9, 1882. N.Y., *Appleton.* 1883. 96 p. 12°.

Studer's popular ornithology: the birds of N. America, drawn and colored from nature; by T. Jasper. N.Y., *Studer.* 1883. 182 p., 119 pl. f°.

Taylor, W. B. Physics and occult qualities. An address before the philosophical society of Washington, Dec. 2, 1882. Washington, *Judd and Detweiler, pr.* 1882. 50 p. 8°.

U. S. — Department of agriculture. Report of the commissioner of agriculture for the years 1881 and 1882. Wash., *Government.* 1882. 704 p., 84 pl. 8°.

Washington — Anthropological society. Transactions. Vol. 1, Feb. 10, 1879–Jan. 17, 1882. Wash., *Society.* 1882. 142 p. 8°.

Washington — Smithsonian institution. Catalogue of publications of the Smithsonian institution (1846–1882), with an alphabetical index of articles in the Smithsonian contributions to knowledge, Miscellaneous collections, Annual reports, Bulletins and proceedings of the U. S. national museum and Report of the bureau of ethnology; by William J. Rhees. Wash., *Institution.* 1882. 328 p. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6 00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

FRIDAY, FEBRUARY 16, 1883.

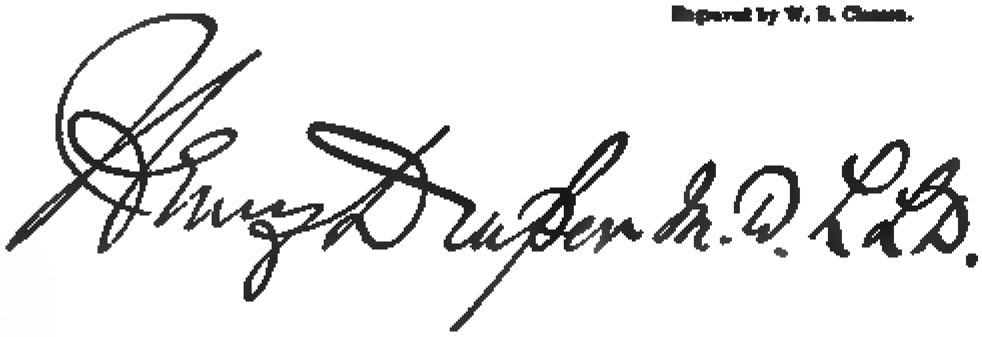
THE LATE DR. HENRY DRAPER.

DURING the past year, the National academy of sciences has lost by death seven out of its membership of less than one hundred, — Professor John W. Draper (the father of the subject of this notice), Admiral John Rodgers, Professor William B. Rogers, Hon. George P. Marsh, Gen. J. G. Barnard, Gen. G. K. Warren, and last, and saddest of all, Dr. Henry Draper.

The five first named were men advanced in years, whose work was substantially complete and finished, so that they had come to the natural end of honorable lives. Gen. Warren also had passed the age of fifty, and for some years had ceased to take any active part in scientific enterprise.

Dr. Henry Draper alone of all the seven was one from whom more even was to be expected in the future than the work he had already accomplished. He was cut off in the midst of his most successful achievements, at the very culmination of his course, just in the fulness of his strength. It is the simple truth, — what another has said already, — that "no greater calamity could have befallen American science than the recent and sudden death of Professor Henry Draper;" because he was now prepared by long experience, by the enthusiasm and confidence born of past success, by ripened judgment, and accumulated resources, for swifter advance than ever before in the important branch of research which he had made his own.

Engraved by W. B. C[illegible].



Only four days before he died, he entertained at his house a company of his scientific *confrères*, with a few other chosen friends. No one then present will ever forget the splendor and beauty of the scene, nor the genial hospitality of the host and his accomplished wife. Few of us ever heard his voice again. He was already suffering from a severe cold contracted by exposure in a storm during a hunting excursion among the Rocky Mountains (he had returned only a few days before), and the labor of preparing for this reception of his friends probably aggravated the trouble. That very night the hand of death was laid upon him, and after three days of suffering and struggle he was snatched away.

He was born in 1837, in Virginia; the second son of John William Draper, then at the

beginning of his brilliant career. The father was at the time a young professor of chemistry in Hampden-Sydney college; he had come to this country from England a few years before, to take a professorship at Boydton, Va., having been induced to come to the United States, partly by the solicitations of his Virginian relatives, and partly by considerations connected with his romantic marriage to a young Portuguese lady of noble birth. In 1839 the elder Draper accepted the chair of chemistry in the New-York university, and removed to the city with his family. Henry Draper, therefore, though by birth a Virginian, and mingling in his veins the blood of both the Anglo-Saxon and the Latin races, was yet entirely a New-Yorker in all his early associations and education, as well as in his later life.

He was educated in the schools of the city, and in the university with which his father was connected. He entered the freshman class at the age of fifteen, and went through the first two years of the college course. His instructors remember him as a bright, active youth, full of spirits, but with a strong taste and bent for scientific pursuits. At the beginning of his junior year he left the college for the medical school, and in 1858 he took his degree of M.D. with distinguished honor.

His education was conducted throughout under the immediate and loving supervision of his father, from whom he inherited such qualities of mind and temperament as qualified him pre-eminently for the work he was to do. A writer in 'Harper's weekly,' speaking of this, says, —

"He had for a companion, friend, and teacher from childhood, one of the most thoroughly cultivated and original scientific men of the present age, who attended carefully to his instruction, and impressed upon him deeply the bent of his own mind in the direction of science. The boy was, in fact, immersed in science from his youngest years; and not merely crammed with its results, but saturated with its true spirit at the most impressible period; he was taught to love science for the interest of its inquiries, and was early put upon the line of investigation in which he has won his celebrity. He inherited not only his father's genius, but his problems of research.

"Dr. John W. Draper was an experimental investigator of such fertility of resource, and such consummate skill, that the European *savants* always deplored his proclivity to literary labors, as a great loss to the scientific world. Henry Draper inherited from his father in an eminent degree the aptitude for delicate experimenting, and a fine capacity of manipulatory tact."

Nothing could be more beautiful than the relation and intercourse between this father and son in later years: on one side was the sincerest filial devotion, respect, and admiration; on the other, paternal pride and confidence; on both sides, the warmest affection, and perfect sympathy of purpose and idea.

Dr. Henry Draper began his researches before he left the college walls. His graduating thesis was a really valuable investigation of the functions of the spleen, and was conducted by means of microphotography, an art then only newly born. In the course of this work he discovered the great value of palladium protochloride in the darkening of collodion negatives. The year after his graduation was spent in Europe; and there, while he did not fail to appreciate and enjoy all that is interesting to every man of culture, still he was most interested in the places, methods, and instruments of scientific research. His visit to the great six-foot reflecting telescope of Lord Rosse, by far the largest ever constructed, gave to his ambition a stimulus and direction which influenced his whole life, and largely determined his career.

On his return he received an appointment in Bellevue Hospital, which he retained for sixteen months, with the intention of practising medicine. In 1860, however, he abandoned this purpose; and by accepting the chair of physiology in the academic department of the university, he definitely adopted the profession of an instructor. During the civil war his work was for a time interrupted by a short term of service in 1862 as surgeon of the twelfth regiment of New-York volunteers; but a military career had few attractions for him, and as soon as he was no longer needed he returned to the duties of his chair. In 1866 he was appointed to the professorship of physiol-

ogy in the medical school. He retained this post until 1873, when he resigned it, but continued to give the instruction in analytical chemistry in the academic department. At his father's death he was appointed to fill the vacant chair, and accepted the position; but only a few months before his death he resigned, and finally severed his connection with the university in order to give himself more entirely to research. At the time when he accepted the chair of physiology in the medical school, and became its manager, the institution had just lost its building by fire, with all its valuable collections. The young director immediately replaced them, largely by funds furnished by himself, and partly by assistance secured from others through his indomitable energy and skilful tact. The school, which seemed to be destroyed, was rehabilitated, and brought to its present state of flourishing prosperity.

His resignation in 1873 was necessitated by the heavy labor and responsibility imposed upon him as managing trustee of the immense estate of his father-in-law, the late Courtlandt Palmer, whose daughter he had married in 1867.

THE TELESCOPES IN THE HASTINGS OBSERVATORY.

As a lecturer and instructor he was eminently successful. Says a writer in the University quarterly (the 'college magazine' of the New-York university), —

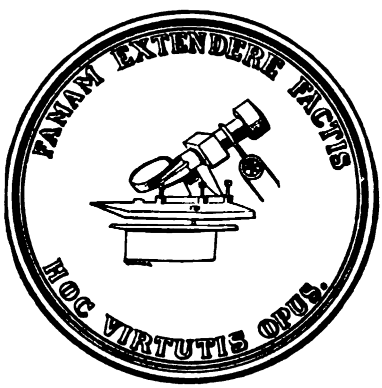
"His lectures are so interesting and absorbing to his hearers, that the question of order, which in some recitation-rooms assumes large proportions, is hardly even thought of with him. After class, an eager group surrounds him; and every tap by inquiring students is followed by a rich stream of information from a mind whose varied treasures always lie at instant command."

But he was still more eminent and successful as an investigator. We have already mentioned his first essay of the sort, and it was soon followed by others more extensive. Immediately upon his return from Europe he began the construction of a fifteen-and-a-half inch reflecting telescope, and carried the work to a satisfactory conclusion. With it he took a photograph of the moon, fifty inches in diameter, the largest ever made, and one of the finest.

Encouraged by this success he aimed still higher, and built another reflector of twenty-eight inches aperture, which was completed in 1872. This, with its equatorial mounting and perfect driving clock, was wholly the work

of his own hands. It was intended and used successfully for the purpose of photographing the spectra of stars. As President Barnard has said, "it was probably the most difficult and costly experiment in celestial chemistry ever made." It was with this instrument

that in August, 1872, he first succeeded in obtaining a photograph of a star-spectrum, showing its characteristic lines: the star was Vega, and the lines were those of hydrogen. Since then he has taken the spectra of more than a hundred stars, and at the time of his death was preparing to push the work much farther. Most of the later photographs were made with an exquisite refractor of eleven and a half inches aperture, by Clark & Sons.



This telescope, which he has found much more convenient than the reflectors, is provided with a special correcting lens for photographic work; and it was with this that he made those wonderful photographs of the nebula of Orion, which were the fruit of his long and weary labors during the two last winters. For the most part he was accustomed to carry on his astronomical work in the summer, while residing at his country-seat on the Hudson; in the winter he generally spent most of the time in the city, and gave himself mainly to laboratory research. In 1872, as a first step towards the interpretation of stellar spectra, he made a photograph of the diffraction spectrum of the sun, extending from below G to O. Others have since then taken pictures of small portions of the spectrum on a larger scale; but his photograph still remains classical and standard, and is recognized as such, abroad as well as here.

In 1874 he was invited by the Transit of Venus commission, to superintend its photographic department; and he did so with such success, that on the completion of his labors the United-States government caused a special gold medal to be struck in his honor at the Philadelphia mint. Upon the face it bears the inscription, "Decori decus addit avito;" on the reverse, "Famam extendere factis, hoc virtutis opus."

Next he took up his famous research as to the presence of the non-metals in the solar atmosphere, and in 1877 published his paper announcing the discovery of oxygen in the sun. The investigation was exceedingly protracted and laborious, and involved an expense of several thousand dollars: it was carried out by means of photography, several hundred plates having been made, which show the solar spectrum confronted with that of the gas. In these plates we find the diffuse, hazy, bright lines of the oxygen spectrum coinciding, not with *dark* lines of the solar spectrum, but with certain brighter bands or interspaces. How this can be, it is far from easy to explain, — why oxygen alone should act in this unprecedented way. Naturally there has been some scepticism and discussion as to the correctness and soundness of his conclusion; but no one with an unprejudiced mind can, we think, resist the evidence after careful examination of the plates, especially those obtained during his second, and still more

elaborate, investigation of the subject in 1878–79.

In the summer of 1878 Dr. Draper organized a party for the observation of the solar eclipse of July 29. His station was at Rawlins, Wyoming Territory; and he succeeded, as did many others, in getting a fine photograph of the corona: he also succeeded, as no one else did, in getting a photograph of its spectrum, which, however, at that time was almost simply continuous.

In 1881 he obtained photographs of the spectrum of the great comet of that year, and also of the nebula of Orion and its spectrum. These pictures of the nebula are among the most remarkable and interesting specimens of celestial photography in existence.

Dr. Draper was not a prolific writer; but every thing he wrote was valuable, — clear, logical, and effective. Early in his career he published an excellent text-book of chemistry; and his paper upon the construction of silvered-glass telescopes, published by the Smithsonian institution, is a work of great importance. In the different scientific journals of England and the United States, he has from time to time published numerous papers giving account of his different researches. Our space forbids a catalogue, but they are mostly enumerated in the obituary notice published in the January number of the Popular science monthly.

Considerable unpublished work remains behind. Among other things should specially be noted the ingenious contrivance by which he succeeded in compelling a prism of bisulphide of carbon to perform satisfactorily in spite of changing temperature; and the equally interesting invention for working the Edison incandescent lamp by means of a gas-engine, without the disagreeable fluctuation of light which usually accompanies the use of such an engine.

Dr. Draper was a member of the Century and Union league clubs, and occupied a high social position. With politics he did not meddle to any extent, though he was always

DR. DRAPER'S OBSERVATORY AT HASTINGS-ON-THE-HUDSON.

patriotic and interested in the public welfare. He was connected with numerous scientific bodies in the city and country, and with many abroad. Though one of the youngest members of the National academy of sciences, he was one of the most effective and influential. Last summer his *alma mater* and the University of Wisconsin honored themselves and him, by conferring upon him simultaneously, but independently, the degree of LL.D.

Excepting his early death, Dr. Draper was a man fortunate in all things: in his vigorous physique, his delicate senses, and skilful hand; in his birth and education; in his friendships; and especially in his marriage, which brought him not only wealth and all the happiness which naturally comes with a lovely, true-hearted, and faithful wife, but also a most unusual companionship and intellectual sympathy in all his favorite pursuits. He was fortunate in the great resources which lay at his disposal, and the wisdom to manage and use them well; in the subjects he chose for his researches, and the complete success he invariably attained.

In person he was of medium height, compactly built, with a pleasing address, and keen black eye which missed nothing within its range. He was affectionate, noble, just, and generous; a thorough gentleman, with a quick and burning contempt for all shams and meanness; a friend most kind, sympathetic, helpful, and brotherly; genial, wise, and witty in conversation; clear-headed, prudent, and active in business; a man of the highest and most refined intellectual tastes and qualities; a lover of art and music, and also of manly sports, especially the hunt; of such manual skill that no mechanic in the city could do finer work than he; in the pursuit of science, able, indefatigable, indomitable, sparing neither time, labor, nor expense.

His loss is lamented keenly, not only by those to whom it is a personal bereavement, but by every sincere lover of truth and science. It must be long before another can be found of such abilities, means, and versatility, to carry on his unfinished work.

But it is violating no confidence to add that his wife, who for fifteen years was his untiring assistant in all his labors, who knew all his plans, and thoroughly understood them too, now hopes and intends to find some way to have his work continued, to utilize the magnificent apparatus he had collected, and so to perpetuate his memory, and keep it forever green by providing for the accomplishment of his most cherished purposes: — Monumentum aere perennius. CHARLES A. YOUNG.

THE WEATHER IN NOVEMBER, 1882.

THE monthly weather review is one of the regular publications of the United-States signal-service. Twenty days after the close of a month is allowed for the receipt of reports, at the expiration of which the review is made up and printed. The November review is an improvement over any of its predecessors, in being stitched and furnished with a neat cover, which contains the name of co-operating observers and of vessels whose officers furnish marine reports, and also a list of meteorological instruments, with the prices at which they may be obtained through the signal-office. The following may be mentioned as the noteworthy meteorological conditions of the month: —

The barometric pressure was nearly normal when compared with the November pressure of previous years. The number of minima sufficiently well marked to allow the charting of their paths is only five, an unusually small number, the average in former years being fourteen. Three of these depressions pursued an easterly track over the northern portion of the country, and two a north-easterly along the Gulf and Atlantic coasts. The latter were the most severe storms of the month.

The temperature was below the normal along the eastern coast and from the Rocky Mountains to the Pacific. In other portions the temperature was higher than the average. Frosts were frequently reported in all districts, the least number being three in the South-Pacific region; while temperatures above 90° F. were reported from Arizona and Texas. The month witnessed the closing to navigation of the upper Missouri and Mississippi rivers and the upper lakes.

There was a marked deficiency in rainfall in nearly the whole country, the principal exception being the middle Pacific coast. New England suffered most from lack of rain; the rainfall, including melted snow, amounting to

only 1.6 inches, the average for November in former years being 4.5 inches. Considerable snow was reported from northern districts, and a little from the southern states.

Among miscellaneous phenomena may be mentioned earthquake shocks, which occurred on the 7th in Wyoming, Colorado, Utah, and Kansas, and on the 14th in Missouri.

The most noteworthy feature of the whole month was the remarkable magnetic storm which occurred from the 16th to the 20th. It prevailed, not only throughout this country, but in Europe, and was characterized by extensive auroral displays. It was simultaneous with a large sun-spot, visible to the naked eye. The English journals have contained many articles upon this storm and its attendant features; but in this country extensive cloudiness prevented as complete auroral observations as would otherwise have been secured.

NEW TESTAMENT AUTOGRAPHS.

An interesting and important application of the methods of the theory of probability to the criticism of the New Testament was made in a paper read by Mr. J. Rendel Harris, late a fellow of Clare College and a lecturer in the university of Cambridge, before the Philological society of Johns Hopkins university, at their meeting on the 5th of January: the results of which investigation will, if substantiated, form a new departure in textual criticism.

Attention was first drawn to the exact equality of the second and third epistles of St. John, each of which occupies 29 lines of type in the edition of Westcott and Hort; and it was remarked, that the text of these epistles probably represented an integral number of sheets of the original papyrus.

An examination was then made of the space occupied by the various books of the New Testament in the Vatican codex. This MS. is written in triple columns, each containing 42 lines to the column. Every book begins at the top of a column; but, strange to say, intead of ending according to a random distribution over the 42 lines of the columns, they show a preference for ending at the 27th or 28th lines.

Five epistles were shown to end on the 27th line, one on the 26th, and two on the 28th.

A calculation was made which showed that this was not the work of chance, but of law; and it was inferred that there was a commensurability of the books in question with one another, with the whole Vatican column, and the partial column of 28 lines.

From this was at once deduced, that the Vatican page is composed of nine smaller pages of papyrus arranged in a square, so that three go to a column, and three columns to the page. Each of these smaller pages was represented by the term V-page; so that a Vatican page is equivalent to the following notation: —

V	V	V
V	V	V
V	V	V

And, since any deviation from the form of papyrus found in the autographs would have resulted in the introduction of a random distribution of the endings, it was shown that the V-page for the books in question was approximately the page of the autograph.

A similar analysis for the Sinaitic codex, which has four columns to the page, and 48 lines to the column, revealed the existence of a smaller papyrus page employed by a number of other books. This page was represented by 12 lines of the Sinaitic column, and was denoted by S; so that the page of the MS. was equivalent to: —

S	S	S	S
S	S	S	S
S	S	S	S
S	S	S	S

By means of these two types the majority of the books of the New Testament were restored to the original sheets.

But even more remarkable was the application of the results of this inquiry to the purposes of textual criticism, and to the stichometry of the New Testament. For these we must refer to the forthcoming supplementary number of the American journal of philology, where it will be found demonstrated, that the celebrated passage of St. John in which is given the account of the woman taken in adultery is, in all probability, four lost pages of the original document of the Gospel; and that the account of the agony in the garden, which is also rejected by the critics, is a lost page of

the autograph of St. Luke. The details of the investigation will be found, with many other points of interest to New-Testament students, in the article above referred to.

INFLUENCE OF MAGNETISM ON CHEMICAL ACTION.[1]

MORE than a year ago I gave an account[2] of some experiments which I had performed with the object of determining whether magnetism exerts any influence on chemical action. I succeeded in getting what appears to me to be strong evidence in favor of the view that magnetism does, at least in one case, exert a marked influence on chemical action. The principal experiment upon which this conclusion is based may be briefly described here. A vessel made of thin iron (ferrotype-plates were used) was placed on the poles of a magnet, and a solution of sulphate of copper poured into it. Instead of getting a uniform deposit of copper on the bottom of the vessel, the metal was deposited in distinctly marked lines, the direction of which was at right angles to the lines of magnetic force. Further, directly over the poles, the deposit was uniform; and this uniform deposit was bounded by a band of no deposit, from one-sixteenth to one-eighth of an inch in width.

Since the first paper on this subject was published, I have spent a great deal of time in endeavoring to discover other cases of similar action, and to extend the observations in various directions, in the hope of reaching a satisfactory explanation of the phenomenon described. I shall soon give a full account of the work in the American chemical journal. In the mean time a condensed account is here given.

I should say at the outset, that the subject of this paper has frequently been discussed and experimented upon in past years. In 1847 Wartmann[3] summed up what had been done previous to that time, and also described some new experiments of his own. According to him, magnetism does not influence chemical action. His proof was furnished by two experiments. In the first, the electrolysis of water was carried on in a magnetic field, and the results compared with those obtained with the same apparatus without the magnet. The results were the same in both cases. In the second experiment, iron cylinders were placed in a solution of copper sulphate. Some of the cylinders were magnetized, and others were not. No difference was observed between the deposits formed. The author calls attention to the fact that his conclusion, that magnetism does not influence chemical action, differs from that of a number of earlier writers, among whom may be mentioned Schweigger, Döbereiner, Fresnel, Ampère, and Robert Hunt; but that, on the other hand, it agrees with that of Otto-Linné Erdmann, Berzelius, and the Chevalier Nobili.

Among the experiments referred to by Wartmann, those of Robert Hunt[1] are perhaps the most striking; and to these I turned my attention. Hunt states, that, when a concentrated solution of silver nitrate or of mercurous nitrate is placed on glass over the poles of a magnet, the salts crystallize out in curious lines, of which an illustration is given. While these experiments have no direct bearing on the question whether magnetism influences chemical action or not, I nevertheless repeated them. To my surprise, the effects described by Hunt were not obtained. The conditions were repeatedly changed, — the strength of the solutions, the strength and form of the magnets, the thickness of the glass plates, being varied; but under no conditions were the expected effects obtained. Some of the other experiments of Hunt were also repeated, but only with negative results. So that even the most positive statements of Hunt will require verification before they can be accepted in favor of his conclusion that magnetism influences chemical action and crystallization.

Among the experiments which I have performed since the publication of the first paper already referred to, may be mentioned the following: 1. The action of copper on zinc. In this case the magnet evidently exerted some influence on the action; causing apparently an accumulation of copper on the lines bounding the space directly above the poles. No lines between the poles like those obtained when copper acts on iron were observed. I am unable to say positively whether the faint figure observed in the zinc was due to an increased deposit of copper or to a lack of deposit. 2. Action of silver on zinc. Indistinct lines were observed, which appeared to be at right angles to the lines of force. These were obtained only when the solution of silver nitrate was quite dilute. 3. Action of copper on tin. The action was evidently modified by the presence of the magnet. 4. Action of silver on lead. No action was

[1] Abstract of a paper read before the National academy of sciences, at its semi-annual meeting in New York, Nov. 14–17, 1882.

[2] American chemical journal, iii. 157.

[3] Philosophical magazine, 1847 [3], 30.

[1] Philosophical magazine, 1846 [3], 281.

observed. 5. Action of silver on iron. A slight effect was produced.

It will thus be seen, that the first experiment described is the one which best exhibits the influence of the magnet. The question still remains, whether the striking effect observed is due to the influence of magnetism on the chemical action, or to some indirect influence of the magnet. An examination of the liquid while the action is going on shows clearly that there are currents in it. Small particles of dust, or any light material, on the surface of the liquid, are drawn towards the poles, and then move in circles above the poles, to the right above one, to the left above the other. We have hence electric currents in the liquid; and these revolve under the influence of the magnet, as we would expect them to. This action gives rise to a streaky condition of the liquid, and this may possibly account for the deposition of copper in the peculiar lines which have been described. I am unable to say whether this satisfactorily accounts for the fact, that the lines of deposit are at right angles to the lines of force; but, as far as I have been able to determine, it does not. Further, if the presence of the currents is the cause of the peculiar deposit of copper on iron, it would appear that the same kind of action should be observed whenever one metal is deposited upon another under the influence of a magnet. This, however, is not the case, as was pointed out above. The fact that the action takes place markedly in the case of iron, and only very slightly, if at all, with other metals, suggests, though it does not prove, that the action is in some way connected with the magnetized condition of the iron. Up to the present I have been unable to experiment with cobalt and nickel. Using nickel-plated brass, I did not succeed in getting any displacement of other metals from solutions by nickel in this condition. Experiments with these metals will of course be of special interest. If it can be shown that with them the same kind of action takes place as with iron, and that with non-magnetic metals it does not take place, the influence of magnetism directly on the chemical action would be practically demonstrated. The slight effects observed with other metals already described may possibly be attributed to the presence of small quantities of iron in the metals experimented upon.

Turning from the ridges of copper deposited on the iron, what is the cause of the space around the outline of each pole upon which no copper is deposited? It is sharply defined; and at the end of the operation it is bright, having remained entirely unaffected by the solution of copper sulphate. Here is evidently a region, not by any means inconsiderable, in which no chemical action has taken place. This can hardly be ascribed to the presence of currents in the liquid. The cause must, I think, be looked for in the magnetized condition of the iron; and I venture, though with misgivings, to suggest, that, the influence of the magnetism being most strongly felt in the iron at the outlines of the poles, these parts of the iron resist the action of the copper sulphate. We may imagine, that the molecules of iron in the regions immediately surrounding the poles are held more firmly than those which are less directly under the influence of the magnet, and that the interference with their motion protects them. Just as, in general, any cause which facilitates the motion of molecules facilitates chemical action, so, also, any cause which interferes with the motion of molecules would probably prevent chemical action either completely or partially. I recognize the crudeness of this suggestion. If there are any objections which can be raised against it, I shall be glad to be informed of them. In the mean time it may at least serve as a working hypothesis, and may lead eventually to a more satisfactory view. I intend to continue experiments on the subject under consideration. Unfortunately, the phenomena which can aid in the solution of the problem appear to be but few, and these do not readily lend themselves to quantitative treatment. The work will necessarily advance slowly, but I shall continue it as long as there appears to be any hope of getting results of value. IRA REMSEN.

ROTIFERA WITHOUT ROTARY ORGANS.

PROFESSOR JOSEPH LEIDY, in a paper recently published in the Proceedings of the Academy of natural sciences of Philadelphia, observes that the Rotifera, or wheel-animalcules, form a small class, abundant in kind, and found almost everywhere in association with algae and with infusorians to which they were formerly considered to belong. Later they were regarded as crustaceans, but now are looked upon as belonging to the group of worms. Their usual striking characteristic, the rotary disks, is not possessed by any well-marked crustacean. Among the Rotifera, however, there appear to be some which do not possess the rotary organs, and yet in all other respects conform in structure to ordinary forms.

Dujardin, Gosse, and Claparede have described rotifers which they regarded as destitute of rotary organs: but Cohn described one with these organs, otherwise resembling the form of Dujardin, and suspects that the latter made a mistake; and remarks that the existence of a rotifer without vibratile cilia would be an abnormal condition in the class. While the forms described by the three authors above named are open to the suspicion that they may possess rotary organs which were withdrawn at the time of

their observation, there can be no question that there are others which are entirely destitute of them, and have efficient substitutes. Of this character is Dictyophora vorax, discovered by Professor Leidy in 1857. The animal is oval, transparent, and fixed in its position. The interior exhibits the usual structure of rotifers, together with the powerful muscular pharynx armed with jaws, observed to be in frequent motion. From the truncated extremity of the body the animal projects a capacious delicate membranous cup more than half the size of the body. The cup is a substitute for the rotary disks of ordinary rotifers, and is used as a net to catch food. At will it is entirely withdrawn into the body with its prey. The animal feeds on smaller animalcules; and in one instance upwards of fifty of these, mostly entomostracans, were squeezed from the stomach. With extended net, the animal measures up to 1 mm. in length. It was found in the Schuylkill River, attached to stones and aquatic plants, and also was observed attached to the sides of an aquarium.

Mecznikow, in 1866, described a similar rotifer under the name of Apsilus lentiformis, found at Giessen, attached to the leaves of the Nymphaea lutea. It especially differs from Dictyophora in the possession of bristled tentacles, and a ganglion to the pouch. Recently, also, Mr. S. A. Forbes of Normal, Ill., has described a similar rotifer with the name of Cupelopagus bucinedax; but this Professor Leidy suspects to be the same as the Dictyophora.

Later Professor Leidy has discovered another remarkable form, which he has named, from the absence of rotary organs, and its restless habit, Acyclus inquietus. It was found attached to the stems of Plumatella, a ciliated polyp, on stones in the Schuylkill River. It was always single, enclosed in profuse bunches of the familiar rotifer Megalotrocha, from which it was rendered conspicuous by its larger size, resembling a giant in a crowd. For the most part, in general structure it resembles Megalotrocha; but as a substitute for the rotary disks of the latter, it possesses a large cup-like head prolonged at the mouth into an incurved beak. The cup is retractile and protrusile, contractile and expansile. When protruded and expanded, the mouth gapes widely, and the beak becomes more extended, but always remains incurved. The animal bends incessantly in all directions, and it contracts and elongates in accord with its surrounding associates. It frequently bends, almost doubling on itself, so as to bring its prehensile mouth within the play of the currents produced by the rotary disks of the Megalotrochae, while the mouth expands and contracts so as to grasp a portion of the food brought within its reach. The movements of the animal are somewhat of a grotesque character, and reminded the author of a zealous demagogue addressing a crowd, obsequiously bowing, and greedily accepting contributions. The length of Acyclus is up to 1.5 mm. in length. The embryo at the time of its escape from the egg is a worm-like body, having the mouth furnished with vibratile cilia.

The original paper is furnished with illustrations representing both Dictyophora and Acyclus.

In one instance Professor Leidy remarks, that he had the opportunity of seeing an individual of Plumatella, with outspread arms, and in its immediate vicinity a group of Megalotrochae with open disks and an Acyclus in its midst, together with two worms of the genus Dero, with extended and expanded branchial tails, all acting together in concert, apparently perfectly regardless of the presence of one another, — messmates partaking of the same repast.

RHYTHMIC MUSCULAR CONTRACTIONS.

CONTINUING those researches on the physiology of the contractile tissues to which we owe so much, Engelmann has lately been at work (*Pflüger's archiv*, xxix. 1882) on the arterial bulb of the frog's heart; selecting it as a muscular organ which contracts rhythmically on stimulation. Preliminary careful study with the aid of some of his pupils confirmed the result of all previous workers, that the bulb contains no nerve-cells. Löwit, however, just as Engelmann had finished his work, described a 'bulbus ganglion:' this led to a fresh histological examination, also fruitless, so that Engelmann finally asked Löwit to send him some of his preparations. These were received and examined. Engelmann unhesitatingly asserts that the supposed nerve-cells are nothing but endothelial elements and connective tissue corpuscles. The isolated arterial bulb is accordingly nothing but a mass of muscular, connective, and epithelial tissues; nevertheless, when filled with blood serum under a suitable pressure, it, like the apex of the ventricle, executes slow rhythmic pulsations. These cease in ten or fifteen minutes, but after a while recommence, and may continue for hours. A single sudden stimulus of moderate strength applied in any pause between two pulsations calls forth, not as in the case of the ventricle a single contraction, but a rhythmic series of such. A weaker stimulus leads to only one beat, or none. Any part of the musculature of the bulb has this property, even pieces cut off and so minute as to need a lens for their observation. It is therefore undoubtedly a property of the muscle elements themselves. The muscle is also conductive: a stimulus applied to a portion united only by a narrow uncut strand with another portion, will arouse contractions in the latter. The stronger the stimulus, up to a maximum limit, the greater the number of pulsations in the series which follows its application, and the less the intervals between the individual contractions of the series. The influence of successive stimuli at not too short (3–5″) intervals is like that observed by Bowditch on the ventricular apex. After long rest, irritability and contractility are diminished; if then equal successive stimuli be applied, of such strength that each only arouses one beat, each beat is more powerful than that which preceded it, until a maximum is reached; at the same time a weaker stimulus than that required at the end of the period of rest becomes sufficient to excite a contraction. Each pulsation nevertheless temporarily exhausts the muscle; if the stimuli follow at less than 2″ intervals, the successive results are smaller. The contraction is always maximal for the given condition of the muscle: a strong stimulus causes no more powerful contraction than a weak, provided the latter acts at all. As in other muscles, a stimulus in itself too weak to cause a contraction makes the organ more sensitive to succeeding stimuli. As a result of this, rapidly repeated (tetanizing) stimuli at first too feeble to influence the bulb may after a time make it give an occasional beat, and ultimately cause rhythmic pulsations: that is, practically continuous stimulation gives rise not to continuous but to periodic contraction. These experiments go far in support of the view which has been gaining ground for some time back, that the rhythm of the heart's action is due not to intermittence in the stimulation sent from its ganglia to its muscle fibres, but to a property of the cardiac muscle tissue itself. The paper also contains interesting experiments on the influence of warmth and cold, and of varied

pressure of its contents, upon the isolated arterial bulb. The most striking temperature observation is, that the bulb, when brought to heat-standstill at or a little above 40° C., will nearly always beat again if the temperature be still raised two or three degrees.

H. NEWELL MARTIN.

LETTERS TO THE EDITOR.

Algae and spray markings.

INCIDENTAL to a note in Nature (xxvii. 46) on Invertebrate casts *versus* algae in paleozoic strata, the writer would call attention to the fact, that he has seen many track-like markings made by dried sea-weeds blown along the shore. In some cases a series of parallel indentations, as if some animal had walked along, were made by the stiff projections of the rolling plant. These algae tracks and markings are very similar to many fossil tracks which have been figured.

Forms similar if not identical with those described by Billings as Arenicolites spiralis from St. John's, Newfoundland, have been seen by the writer to be formed on the beach by the spray. This was especially observed last autumn at Marblehead Neck. The spray dashing over a projecting rock, and falling on the wet sands left by the retreating tide, produced a series of drop and ring like markings in the sand, varying in size from minute drops to those one or two inches in diameter. This corresponds, as regards size, with the specimens of Arenicolites collected by the writer at the Newfoundland locality. The common form of the larger spray markings is that of a ring, with a raised centre and a depressed border, surrounded by the displaced sand. The appearance is as if the drop fell like a partly closed bell of a jelly-fish, and then expanded outward in every direction, carrying the sand with it, but leaving the central portion untouched. These forms would probably be somewhat modified by the next tide, causing variations in the structure, if not obliterating the forms for the most part. As in Newfoundland, so on this modern beach, the impressions are seen crowded together, as well as singly. (See *Can. nat.*, (2), vi. 478; *Geol. survey Canada, pal. foss.*, ii. 77; *Amer. journ. sc.*, (3), iii. 223.)

M. E. WADSWORTH.

Cambridge, Mass., Jan. 9, 1883.

Geology of Lake Superior.

I am pleased to learn from a communication published in your number of Feb. 9, and signed A. R. C. Selwyn, that the present head of the Geological survey of Canada has arrived at conclusions with regard to the geology of the Lake-Superior region precisely similar to those reached and published by Foster and Whitney over thirty years ago.

That it would have been well for the Canada survey, and for geological science generally, if more attention had been paid by Mr. Logan and his assistants to the results of the survey carried on along the south shore of the lake by the U.S. geologists, during the years 1848 to 1850, will, it is thought, become apparent to every geologist who reads a work prepared by Dr. Wadsworth and myself, soon to appear in the bulletin of the Museum of comparative zoölogy, and entitled 'The azoic system and its subdivisions.'

J. D. WHITNEY.

Cambridge, Feb. 12, 1883.

Rock disintegration in hot, moist climates.

Some remarks of Nordenskiöld, in his 'Voyage of the Vega,' pp. 707–713, relating to precious stones, suggest the thought that the marked differences which occur as to the manner and rate of the weathering of granitic rocks at the north and at the south can hardly be so familiar to European scientific men as they are to American observers. At the south it is common enough to find soils that have been formed 'in place,' from the thorough and deep-seated chemical decomposition of the rocks on which they rest; while at the north, well-marked disintegration of this sort is rarely met with, even in places where the observer is not perplexed and confused by the mechanical results of glacial action. The subject has often been alluded to by American geologists, working in our southern states, notably by Professors Kerr of North Carolina, and Stubbs of Alabama, who have expressed themselves in the following terms: Speaking of the geologic formation which, "after hugging the east side of the Appalachian chain of mountains and forming some of the most valuable farming lands of the Atlantic states, enters the central eastern part of Alabama," Professor Stubbs says, "The rocks which by disintegration have given the soils of this section are mainly granites, gneisses, feldspars, hornblendes, mica-schists, etc.; and much the greater part of the section is covered by soils which have resulted from disintegration of the above-mentioned rocks *in situ*. And here I may remark a notable feature of these soils, — a feature which cannot fail to arrest the attention of every northern geologist: viz., that decomposition of these rocks in southern latitudes has proceeded much farther than with the same rocks in higher latitudes, and therefore has given us deeper soils. It is difficult to find in the north a soil over a few feet deep; while here it is not uncommon to find in railroad-cuts, wells, etc., disintegrated strata to the depth of thirty, fifty, or even seventy-five feet. This can be accounted for to a large extent by climatic influences. The warm waters, charged with carbon dioxide, percolating throughout the year the easily permeable strata, act continuously as a chemical agent in the work of disintegration; while farther north not only the amount of water, the temperature, and the chemical activity are reduced, but for one-half of the year the soil is locked up by frost from all access of decomposing agencies."

The influence of these soils of disintegration upon the agriculture of the regions in which they occur, has often been noticed; and their bearing upon the history of the use and manufacture of commercial fertilizers in this country is no less clearly marked. It would seem to be plain, that disintegration such as this, when accompanied with or followed by denudation, would readily account for the accumulation, and, so to say, concentration in 'pockets,' or other places of rest, of any heavy or refractory minerals which were originally contained, dispersed, in the native rock; and that among the multitude of individuals thus thrown together there would be much greater likelihood of finding superior specimens than can be obtained by searching the comparatively meagre deposits that are formed at the north.

The statement of Nordenskiöld, above referred to, is here given in condensed form.

"Precious stones occur in Ceylon mainly in sand-beds, especially at places where streams of water have flowed which have rolled, crumbled down, and washed away a large part of the softer constituents of the sand, so that a gravel has been left which contains more of the harder precious-stone layer than the originally sandy strata or the rock from which they originated. Where this natural washing ends, the gem collector begins. He searches for a suitable valley, digs down a greater or less depth from the surface to the layer of clay mixed with coarse sand resting on the rock, which experience has taught him to contain gems. . . . The yield is very variable, sometimes abundant, sometimes very small. . . . Sapphires are found much more commonly than rubies. . . . The precious stones occur in nearly every river valley which runs from the mountain-heights in the interior of the island down to the lowland. . . . But some one perhaps will ask, Where is the mother-rock of all these treasures in the soil of Cey-

lon? The question is easily answered. All these minerals have once been embedded in the granitic gneiss which is the principal rock of the region" (and which weathers readily).... "In weathering, the difficultly decomposable precious stones have not been attacked, or attacked only to a limited extent: they have therefore retained their original form and hardness. When in the course of thousands of years, streams of water have flowed over the weathered rock, the softer constituents have been for the most part changed into a fine mud, and as such washed away, while the hard gems have only been inconsiderably rounded and little diminished in size. The current of water, therefore, has not been able to wash them far away from the place where they were originally embedded in the rock; and we now find them collected in the gravel-bed, resting for the most part on the fundamental rock which the stream has left behind, and which afterwards, when the water has changed its course, has been again covered by new layers of mud, clay, and sand.... Of all the kinds of stones which are used for ornaments, there are both noble and common varieties, without there being any perceptible difference in their chemical composition. The most skilful chemist would have difficulty in finding, in their chemical composition, the least difference between corundum and sapphire or ruby; between common beryl and emerald; between the precious and common topaz; between the hyacinth and the common zircon; between precious and common spinel: and every mineralogist knows that there are innumerable intermediate stages between these minerals which are so dissimilar, though absolutely identical in composition. This gave the old naturalists occasion to speak of ripe and unripe precious stones. They said that in order to ripen precious stones the heat of the south was required. This transference of well-known circumstances from the vegetable to the mineral kingdom is certainly without justification. It points, however, to a remarkable and hitherto unexplained circumstance; namely, that the occurrence of precious stones is, with few exceptions, confined to southern regions.... Another remarkable fact in connection with precious stones is, that most of those that come into the market are not found in the solid rock, but as loose grains in sand-beds. True jewel-mines are few, unproductive, and easily exhausted. From this, one would be inclined to suppose that precious stones actually undergo an ennobling process in the warm soil of the south."

To the writer of this note, it seems more reasonable to suppose that the greater abundance of noble gems in southern climates should be attributed to the more active and thorough-going disintegration which occurs in those regions, and to the consequent — comparatively speaking — enormous accumulation and concentration of the precious minerals, as above suggested. Other things might be far from being equal, and yet the chance of finding a stone of price be greater in a heap of ten thousand rough jewels than in a collection which contains but a few score.

Bussey Institution. F. H. STORER.

The November aurora in California.

Auroras are exceedingly rare phenomena in southern California; yet we had the pleasure of witnessing one Nov. 17, at which time a great electric storm raged over North America and Europe. The photographic traces during the time from Nov. 10 to Nov. 20 are very interesting; as they have preserved a perfect record of the twitchings and jerkings, large and small, fast and slow, to which the magnets were subjected during this time.

A slight shock of earthquake was reported here on Jan. 23, about 5.20 P.M. I was on the street, and did not feel it; and so far as I can detect no harm was done at the observatory. MARCUS BAKER.

Los Angeles, Cal., Jan. 26.

TRYON'S CONCHOLOGY.

Structural and systematic conchology: an introduction to the study of the Mollusca; by GEORGE W. TRYON, JR. Vol. I. Philadelphia, *the author*. 1882. 8 + 312 p., cuts, 22 pl. 8°.

WE have received the first volume of Mr. Tryon's new work (to be completed in three volumes), intended as an introduction to the study of the mollusks. This portion consists of some general considerations, a description of the anatomy, habits, and economy, distribution in space and time, notes on nomenclature, classification and collection, of mollusks. Assistance in paleontological matters has been rendered by Prof. Angelo Heilprin. The work is well printed and bound; but the plates, though not so bad as in the 'Manual' of the same author, contain mostly inferior renderings from old and familiar figures, produced by processes which cannot be made to yield really good results. The map is very badly drawn, and besides this, through 'overlaying,' resulting from folding and inferior or excessive ink, has become nearly illegible. Mr. Tryon frankly disclaims authorship for his compilation, which is derived almost wholly from Woodward's well-known 'Manual,' and the earlier parts of Dr. Paul Fischer's 'Manuel de conchyliologie,' now in process of publication. Since both these works are accessible at a total price less than that of the first volume of Mr. Tryon's book, it is not clear why the latter should exist. Perhaps the future volumes will explain.

Meanwhile we do not feel that any very warm welcome should be extended to a work of compilation so destitute of perspective as this. Though not what the author would have made it had Lovèn's work on the dentition of mollusks appeared ten years earlier, Woodward's book is nevertheless a thoroughly coherent manual, in which the parts retain proper proportions to each other and to the whole. There are many statements in it which are now obsolete, or supplemented by more precise, fuller, or more accurate information. Groups not recognized by Woodward have attained their majority, and no longer train timidly in the leading-strings of a few bold specialists. The study of embryology, histology, and general anatomy, has entirely changed the situation so far as the point of view is concerned; but the great merits of Woodward, as originally published, are as conspicuous as ever. The work of Dr. Fischer is directly on Woodward's lines, and embodies of course much of his information; but it is not a mere revision, an ill-considered conglomeration like that of Tate, nor such a compilation as the present one of Tryon's. Silk and leather are good in their places; but man does not patch one with the other, or, doing so, repents of it. Mr. Tryon's first volume appears to us to resemble a mosaic of granite, chalk, precious stones, and mud, which is not delightful to the eye, neither will it wear. The work of the last twenty years in general, except so far as embodied in the ex-

tracts from Fischer, finds no place in it, though here and there an isolated fact is planted side by side with some crude observation of the first quarter of this century. Ihering's classification, the most pregnant and suggestive (if not the most successful) attempt in many years, is not even mentioned. There is shown no grasp of the subject; and, on contested questions of importance, the treatment recalls a man in a menagerie poking up the animals through the bars. Errors of fact and of the types could be cited in abundance: but it is not necessary to descend to small details; the real fault is with the architecture, not with the bricks.

THE PARIS METEORITES.

Guide dans la collection de météorites du Muséum d'histoire naturelle. Paris, *Masson.* 1882. 40 p. 8°.

THIS little work of some forty pages is valuable as giving in brief the results of the extended studies upon meteorites by Prof. A. Daubrée and his assistant Dr. Stanislas Meunier. Besides furnishing a catalogue of all the specimens to be found in the collection, three hundred and six in number, it discusses the origin, characters, classification, etc., of meteorites. These are regarded as having a common origin, and possessing types corresponding to rocks and structures of terrestrial origin, i.e., to lavas, dunite, lherzolite, serpentine, breccias, pumice, metallic veins, metamorphic rocks, etc. The classification is one which, in its simpler divisions, has been well received, but in the minor subdivisions is but little known; hence it is a matter of interest to place this classification in its latest phase before our readers.

METEORITE.

I. HOLOSIDERITE.
Octibbehite, tazewellite, nelsonite, catarinite, braunite, caillite, schwetzite, jewellite, campbellite, burlingtonite, tuczonite, lenartite.

II. SYSSIDERITE.
Pallasite, atacamaite, brahinite, deesite, lodranite.

III. SPORASIDERITE.
1. *Polysiderite.* — Toulite, logronite.
2. *Oligosiderite.* — Aumalite, chantonnite, aiglite, montrejite, parnallite, luceite, canellite, mesminite, belajite, butsurite, manbhoomite, banjite, limerickite, menite, bustite, richmondite, tieschite, erxlebenite, quincite, stawropolite, tadjerite, rutlamite, renazzite.
3. *Cryptosiderite.* — Howardite, ornansite, chladnite.

IV. ASIDERITE.
Igastite, rodite, eukrite, shalkite, chassignite, bokkevelite, orgueillite.

The principal divisions, as will be readily seen, are based on the presence or absence of iron, and its relations to the associated silicates when they are present. The subdivisions are named from the localities at which the specimen chosen as a type happened to fall. It is unfortunate that the bibliographical index, professing to give the principal works relating to meteorites, should be so very imperfect, — giving only *eight* works and papers, omitting such as the classical publications of Chladni in 1819, Schreibers, and Partsch, and the more recent ones of G. Rose, Shepard, Clark, Harris, Rammelsberg, Kesselmeyer, Phipson, Lawrence Smith, and others.

EARLY ORIENTAL HISTORY.

Histoire des anciens peuples de l'orient; par LOUIS MÉNARD. Paris, 1882. 468 p. 8°.

THIS work contains the outlines of Egyptian, of Assyrio-Babylonian, and of Israelitish history. Parts i. and ii. are profusely illustrated from the monuments. Part ii. (Assyria and Babylonia) covers 102 pages, and discusses in five chapters the region of the Tigris and Euphrates, the primitive times, the Sargonidae, the new Chaldean empire, the monuments, religion, manners, and customs. The author tells in a pleasing way what he knows of these topics; but, unfortunately, he is not a student of Assyriology, nor has he informed himself as to the latest results of Assyrian study. His authorities are the Old Testament, Berosus, and the classic writers and the older generation of explorers and decipherers (Botta, Layard, Rawlinson, Hincks). Of the younger generation, with one or two exceptions, he knows absolutely nothing (Smith and Sayce in England; Halévy, Pognon, and Guyard in France; Schrader, Delitzsch, and others in Germany). Hence he quotes (p. 261) from Berosus the Chaldean legend of the deluge, and points out its similarity to the biblical account, without even mentioning the cuneiform deluge story discovered by the lamented George Smith. On p. 262 he tells us that the name 'Babylon' seems to mean 'gate of god.' Certainly this meaning is above possible doubt. He informs us (pp. 262, 263) that the people of Accad and Sumer are of different race; the former being Cushites, and speaking a language approaching the Semitic tongue, the latter being of the Scythic or Turanian stock. He has evidently never heard of Paul Haupt, who has shown that the peoples of Sumer and Accad spoke the same language with dialectical differences, — a language utterly unlike any Semitic tongue. He says (p. 273) that 1112 B.C. is the oldest date which can be established for the history of Assyria. He should

have added, that, before this time, there is a long line of Assyrian kings, for many of whom the date can be fixed at least approximately. The author informs us that it has been supposed that the person kissing the foot of Shalmaneser on the black obelisk may be Jehu, king of Israel, whose name, he tells us, is mentioned in the inscription (p. 278). The Israelitish face of the kneeling figure, and the fact that the name Jehu (Assyr., *Ya-u-a mar Hu-um-ri-i* = Jehu the son of Omri) stands immediately above the picture, ought to allow of no doubt in the matter. The statement (p. 285) that Shalmaneser, the predecessor of Sargon, is not once mentioned in the cuneiform inscriptions, is incorrect; for he is named in the Eponym canon (III. R. 1. col. V. 1),[1] and at least one other time (cf. George Smith: The Assyrian canon, p. 84). The author gives the conflicting opinions of Lenormant and Maspéro, as to the fate of the rebellious brother of Assurbanipal (p. 301). Assurbanipal's own statement is explicit to the effect that his brother was burned, though the gods are represented as having performed the work (V. R. 4. 46 ff.). It is misleading to say (p. 275) that the Assyrian kings never tried to hold by mild government their conquered provinces; for the later kings at least often bestowed favors on captive princes, not seldom replacing them on the throne. Such cases of inaccuracy and uncertainty might be multiplied. The writer knows too little of recent work in Assyriology, and does not hesitate to express his scepticism as to the way in which Assyrian students read proper names (pp. 271, 301). One who has not studied the language for himself can, of course, not yet write a history of Assyria and Babylonia. The book has the credit of brevity, and gives very well a general impression, but cannot be relied upon in detail.

[1] R. is the usual way of representing the great collection of Assyrian texts called 'The cuneiform inscriptions of Western Asia,' of which Sir Henry Rawlinson is editor. The Roman numeral preceding indicates the volume; the following numerals refer to the page, column, and line.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Transit of Venus observations at Helderberg, N.Y. — Mr. R. H. Tucker, jun., of the Dudley observatory, gave a detailed account of the arrangements for, and results of, his observation of the transit of Venus, at a station established for the purpose on the Helderberg table-land, about thirteen miles westward from the city of Albany. The site chosen was the U.S. coast and geodetic survey, and the N.Y. state survey station, Helderberg; lat. 42° 37′ 38″, long. 74° 00′ 39″; altitude, 1,823 feet. The cloudiness which prevented the observation of either contact at the Dudley observatory was but partial at the Helderberg station, and a satisfactory view of the second contact was realized. An estimate was also made of the time of the first contact, based upon a comparison of the phase first seen a few minutes later, with diagrams constructed in connection with preliminary practice.

The errors of the chronometers were obtained by heliotrope signals, and powder-flashes from the Dudley observatory, and by sextant observations of the sun. — (*Albany inst.; meeting* Jan. 2.) [80

Transit of Venus observations at New Haven. — Prof. H. A. Newton described his temporary mounting by which he used the eight-inch Grubb object-glass of the observatory to observe the contacts. Dr. L. Waldo referred to the preliminary drill with the Yale heliometer which the five observers and assistants with that instrument had undergone, and said that the results were extremely satisfactory. The definition was good most of the day, and the instrument and dome was manipulated quickly with no waste of time. He gave the following summary: 24 half sets of 4 pointings each, 10 whole sets of 8 pointings each, 20 single pointings on Venus for its diameter, 10 position measures at ingress, and 6 position measures at egress, with time observations of the four contacts. Mr. Willson described an arrangement by which he had put a cast-iron cylindrical plate-holder in the eye end of the Grubb telescope, and had projected a mercury horizontal surface, together with the reticule glass lines on each of the hundred and fifty or more photographs he had reason to think would develop well. He also described a ten-foot rod caliper he had used in measuring the plate distance from the object-glass. He used a simple crown lens of about one inch and a quarter aperture, and ten feet focal length.

Mr. Sherman, through the courtesy of the scientific school, used the nine-inch equatorial, and obtained about eighty-seven sets of transits of Venus and the sun's limbs across a system of inclined lines ruled on glass. Professors Van Vleck, Lyman, Wright, and Brewer took part in the discussion following the above papers; and, after describing their own contact observations, referred to the atmosphere of Venus, and in general regarded the want of intense blackness of Venus's disc as an effect of contrast with the sun. — (*Conn. acad. arts sc.; meeting* Dec. 20.) [81

MATHEMATICS.

Septic transformation. — Mr. Ely has obtained the modular equation for the septic transformation by a purely algebraical process. Aside from the result directly arrived at, the paper is valuable as affording a clew as to the (algebraical) methods of procedure to be followed in obtaining the odd prime transformations of higher orders. — (*Proc. Lond. math. soc.*, 1882.) T. C. [82

Transformation of elliptic functions. — This paper, by Professor Smith of Oxford, is too important for a brief abstract. On its completion, a proper review will be given of its contents. — (*Mess. math.*, 1882.) T. C. [83

Curves of any deficiency. — Mr. Buchheim ex-

tends the theory of Steiner's polygons and Prof. Sylvester's theory of derivation to the case of curves of order n and deficiency p in an $(n-p)$ flat. The extension involves the use of Abelian functions instead of elliptic functions, as in the case of a plane cubic, and is based principally upon Clifford's well-known paper, On the classification of loci. — (*Proc. Lond. math. soc.*, 1882.) T. C. [84

Fourier's functions. — M. Nicolas prefers to denote, by this title, the functions more commonly known as Bessel's or cylindric functions. The author studies principally the different modes of representation of these functions by definite integrals and series. A novelty is the introduction of a method of Euler's in finding the development in form of a series of the functions of the second kind. — (*Annales école norm.*, xi., *suppl.*, 1882.) T. C. [85

Geometry of n-dimensions. — The author, M. V. Schlegel, here extends certain well-known theorems of ordinary plane and three-dimensional space geometry to a space of any number of dimensions. The paper deals only with completely limited figures, regular and irregular. *A homogeneously limited figure* is defined: 1°, as one in which each summit meets the same number of edges, planes, solids, etc.; 2°, as one in following any edge of which we meet the same number of edges, planes, etc. Writing 'homogeneous' instead of 'limited homogeneously,' we see that all plane polygons are homogeneous, etc. The author uses the methods of Grassman, and extends to hyper-space theorems concerning the triangle, quadrilateral, tetrahedron, hexahedron, and octohedron. — (*Bull. soc. math. France*, x., 1882.) T. C. [86

Curves whose co-ordinates are elliptic functions. — R. von Lilienthal discusses two classes of spherical curves having the following properties: The constants in the expressions for the co-ordinates, with the exception of one (which, with the modulus, is arbitrary), can be so determined that the sought curve shall lie on a sphere. The length of an arc of the curve can be given as an elliptic integral of the first kind increased by the difference of two elliptic integrals of the third kind.

For the second group of curves, the arbitrary constant can be so determined that the integral giving the length of arc shall be an elliptic integral of the first kind. It is also shown that the curves of the second kind lie on algebraical cylinders. — (*Journ. reine angew. math.*, xciii., 1882.) T. C. [87

Applications of the theory of binary forms to elliptic functions. — The author, Faà de Bruno, expresses the elliptic functions by aid of the absolute invariant, and gives a very rapidly converging series for the computation of the complete elliptic integral of the first kind. — (*Amer. journ. math.*, 1882.) T. C. [88

Rotation of a solid body. — This treats the case of rotation of a solid body about a point which is in general neither the centre of gravity of the body nor (in the case of a body of revolution) a point on the axis of revolution. The author, W. Hess of Munich, discusses the general case, and obtains several interesting theorems on making particular hypotheses as to the position of the point about which the body rotates. — (*Math. annalen*, xx., 1882.) T. C. [89

Vibrations of an elastic sphere. — Prof. H. Lamb here discusses the problem of the vibrations of an elastic solid whose dimensions are all finite. He has given several numerical calculations and diagrams, illustrating, in special cases, the results arrived at by the purely mathematical investigation. The author points out that the results of his analysis differ from the views advanced by Lamé (Théorie de l'élasticité) as to the nature of the fundamental modes of vibration of elastic solids in general; and indicates the error in Lamé's reasoning as consisting in the tacit assumption that a wave undergoes no change of character on reflection at the bounding surface of a solid, — an assumption the incorrectness of which was previously shown by Green. — (*Proc. Lond. math. soc.*, 1882.) T. C. [90

Subinvariants. — An important paper by Professor Sylvester, of which, since it is not yet completed, a review will be given at a later date. — (*Amer. journ. math.*, v., 1882.) T. C. [91

PHYSICS.

Apparent attractions and repulsions of small floating bodies. — The need of a thoroughly sound and at the same time simple popular explanation of capillary phenomena will probably make every teacher of elementary physics take up Prof. Leconte's article with interest. As he states, ordinary treatises are somewhat unsatisfactory upon this subject, even when they are not actually wrong. For instance, the in general excellent treatment of capillary action in Everett's 'Deschanel' handles the phenomena observed in a vacuum in a very gingerly manner, hinting at a certain mysterious pressure in the interior of liquids due to molecular action at the surface, even when such surface is plane, in order to account for the rise of liquids in fine tubes in a vacuum.

In view of the fact that the capillary action of liquids is practically the same in a vacuum as in air, Prof. Leconte appears to be of the opinion that it is unnecessary to take account of atmospheric pressure in explaining any of these phenomena. He proposes to base his explanation upon two 'fundamental principles:' 1. "That in every case, whether of moistened or non-moistened bodies, there exists an adhesion between the solid and the liquid." 2. "That the capillary forces are, in any given case, inversely proportional to the radii of curvature of the meniscuses, and their resultants, directed toward the centres of concavity."

We suppose Prof. Leconte will admit, however, that although the visible phenomenon of water sustained in a capillary tube, for instance, may remain unchanged when the surface of the water is relieved of the pressure of the atmosphere, the actual condition of water in the tube and of the film at the top of the column is somewhat changed. Thus Young says in his memoir on the 'Cohesion of fluids,' "when the surface is concave, the tension is employed in counteracting the pressure of the atmosphere, or, where the atmosphere is excluded, the equivalent pressure arising from the weight of the particles suspended from it by means of their cohesion," etc. In fact, it would seem the better plan in explaining the above phenomenon, to make full use of the unquestionable agency of the atmospheric pressure, so long as the atmosphere is present, and be thankful for it, since it is far easier to understand than the sustaining by cohesion that must take its place in a vacuum.

Prof. Leconte's statement of his second principle is a little puzzling; for a natural interpretation of his words would be, that he supposes the *surface tension* to be inversely proportional to the radius of curvature of the film. He applies his two principles to the explanation of three typical cases of attraction and repulsion. In the case of two moistened bodies he says, "But when brought so near that their meniscuses join each other, the radius of curvature of the united intervening concave meniscus . . . is less than that of the exterior concave meniscuses, . . .

and its superior tension acts upon both bodies toward a common centre of concavity."

We do not think physicists generally will admit that a liquid film tends to draw a solid, to which it is attached toward the centre of concavity of the film. Indeed, if this were so, the tendency of a column of water raised between two floating bodies by surface tension would be to lift those bodies: similarly a column of liquid sustained in a fine tube would tend to lift the tube. This action, however, is denied both by theory and experiment. In fact, unless we have misunderstood Prof. Leconte's language and diagrams, his article will not do all that it was intended to do, toward removing the difficulties in the way of a student beginning the study of capillary phenomena. — (*Amer. journ. sc.*, Dec., 1882.) E. H. H. [92

Rigidity of the earth. — G. H. Darwin discusses the long-period tides — the lunar fortnightly declinational and the lunar monthly elliptic — from 33 years' observations in England, France, and India, and finds that they are reduced to 0.7 of their theoretic height. There should be no reduction on a rigid earth, and no ocean tides on a liquid earth: as the actual effect of the earth's yielding to the moon's attraction is only 0.3 of the difference between these extreme effects, the earth is considered at least as rigid as steel. — (*Nature*, Nov. 2, 1882.) W. M. D. [93

Optics.

Molecular refraction. — In an investigation on the refractive powers of carbonic ether and its sulphur substitution products, E. Wiedemann finds that the atomic refraction of sulphur depends upon its place in the molecule as does that of oxygen. — (*Wied. ann.*, Dec., 1882.) C. S. H. [94

Dispersion formulas. — A. Wüllner shows that in a large number of colorless substances, in which case the absorption constant may be regarded as zero, two of the constants in Helmholtz' dispersion formula are sensibly equal, and the formula reduces to one of two constants, which is then equivalent to that of Lommel. The same was found to hold true of an alcoholic solution of alizarine, as also of an aqueous solution of amonio-sulphate of copper. — (*Wied. ann.*, Dec., 1882.) C. S. H. [95

Diffraction. — A series for the calculation of Fresnel's integrals, and a table of values, are given by A. Lindstedt. — (*Wied. ann.*, Dec., 1882.) C. S. H. [96

(Photometry.)

Photometric observations of the transit of Venus. — Professor E. C. Pickering has made some comparisons of the brilliancy of the sun, of Venus, and of the region in the immediate vicinity of the limb of the sun, whereby the photometric illumination of that portion of the corona may be determined. An ordinary double-image-prism photometer with a few slight modifications, attached to the tail-piece of the 15-inch equatorial, was employed for the observations. Calling the light of the sun 100, the mean of thirty-two settings taken between 1 h. 07 min., and 1 h. 30 min., Cambridge mean time, gave: Venus 1.8, and the sky 8.8. The mean of twenty-four settings taken between 2 h. 48 min. and 2 h. 54 min. gave: Venus 1.4, and the sky 6.2. The mean of all gave: Venus 1.6, and the sky 7.5 or 4.7 times as bright as Venus. [According to this, the light of this portion of the corona would seem to be about 3.7 times as brilliant as the light reflected by that portion of our atmosphere lying between us and the sun.] — W. H. P. [97

Heat.

Thermal conductivity of rocks. — A novel method has been employed by M. Thoulet for the determination of the thermal conductivity of minerals and rocks. Instead of measuring the temperatures at different distances from the source of heat, measurements are taken of the time required for the passage of a certain quantity of heat through a section of known thickness. The 'thermal resistance' is defined as the time required for the passage of a definite quantity from a source at 100° C. through a thickness of 0.01 mm. The thermal resistance is consequently inversely proportional to the thermal conductivity. Glass and iron have already been experimented on, and the method appears to give very accurate results. — (*Ann. chim. phys.*, (5). xxvi. 261.) C. B. P. [98

Heat of combination a function of atomic weight. — Mr. Laurie shows, that if the atomic weights of elements are taken as abscissae, and their atomic heats of combination with chlorine, bromine, or iodine, as ordinates of a curve, the heats of combination will be seen to be a periodic function of the atomic weights. — (*Phil. mag.*, Jan., 1883.) C. B. P. [99

Electricity.

Electrical resistance of selenium cells. — In a communication to the Physical society of London in June, 1881, Dr. James Moser urged that the decrease in electrical resistance observed in a 'selenium cell' when acted upon by a beam of light, is due to heating, which by expanding the selenium makes it press more firmly against the metallic electrodes of the cell, thus establishing better connection. The fact that luminous are more effective than obscure rays in producing the observed change, Dr. Moser sought to explain as a result of selective absorption. Mr. Shelford Bidwell undertook to put Dr. Moser's theory to the proof by heating selenium cells to known temperatures in the dark, and observing the consequent change in electrical resistance. It appears from his experiments, that below a certain temperature, which is different for each cell, heating increases the electrical resistance of the cell; that above this temperature heating decreases the resistance, the temperature of maximum resistance being usually somewhat above ordinary temperature, but in one case being 13° C. Mr. Bidwell concludes, however, that the action of the luminous rays upon the cell cannot be explained by their heating effect alone; for he finds that whereas a moment's exposure to direct sunlight, though causing a great fall of electrical resistance, yet heats the selenium to a hardly perceptible extent, an equal decrease of resistance caused by heating in the dark could be produced only by making the cell too hot to handle. Mr. Bidwell concludes from his experiments that the action of the *carbon* photophone is to be explained by the heating alone. — (*Phil. mag.*, Jan., 1883.) E. H. H. [100

ENGINEERING.

Practical test of the safety of bridges. — It is well known among engineers, that, with good iron properly used, our bridges may be relied upon for an indefinite length of service. The best practice never loads a structure with more than from one-fourth to one-sixth of the weight that would break it down. Any load put upon a piece of iron will stretch it to a slight extent. Upon removing the load, the iron should regain its original form. This it will do if it has not been overstrained. A very simple and effective piece of mechanism has been for some time in use at the East-River suspension-bridge at Brooklyn for determining the precise effect of any load upon any part of the structure. A bar ten or twelve feet long is attached to any member of the bridge in such a manner that any increase in the length of such

member is at once imparted to the standard bar, and is so multiplied by delicate mechanism as to become plainly visible. In testing a bridge, a movable index upon the standard bar is first placed at zero. A load is then run on to the bridge, when the index moves on account of the stretch imparted by the bridge to the standard bar. The weight is now removed from the bridge, when the index returns to zero unless the iron has received a permanent elongation from the load — that is, unless the iron has been overstrained. Not only does this method enable us to determine whether a bridge is safe for the time being; but we can also answer the not less important question, whether the bridge is holding its vitality through long periods of time. The above apparatus is so delicate as to indicate a strain on the iron less than a thousandth part of the weight that would break it. By means of this device, not only do we substitute exact measurement for mere opinion, but we are enabled to answer a good many vexed questions in regard to the precise condition of complex structures of iron. G. L. V. [101

Cable power for street-railways. — There is probably no more abused piece of motive power than the horse which draws our street-cars. Leaving out of view the outrageous cruelty to which these unfortunate animals are often subjected, it may well be questioned whether such power is in any way economical. Whether steam or electricity will soon be employed upon street railways, may be questioned; but there is reason to think that the so-called cable system may furnish a solution to many of the problems in city transportation. There is nothing new in the idea of a continually moving, endless wire cable beneath the roadway, to which cars may be attached at any point; but to reduce the idea to practice involves a good deal of mechanical skill and a very considerable expense. Mr. J. D. Miller gives a description of the Chicago cable roads, in which he states, that, in October last, there were in Chicago over four miles of cable roads in operation, — an amount which has been largely increased since that time. The first cost of these roads is reckoned to be not less than $100,000 a mile for a double track. The cost of operation is said to be much less than by the common method, the percentage of saving being greater as the traffic becomes larger. — (*Journ. assoc. eng. soc.*, Oct.) G. L. V. [102

Tests of building materials. — An important series of experiments upon the strength of timber has been for some time past carried on by Professor Gaetano Lanza at the institute of technology in Boston, and also at the Watertown arsenal. The experiments from which the data in our books have been determined were in nearly all cases made upon very small and very carefully selected pieces of well-seasoned wood. From the data thus obtained we have assumed that we could at once pass to the more or less defective and generally quite unseasoned timber which is employed in actual work. This method has often led to most absurd and unreliable results, and has been a fruitful source of that discordance which so often appears between science and practice. Instead of small wooden beams an inch square and two or three feet long, Professor Lanza uses beams twenty feet long and of the common sizes used in building; and, instead of the perfectly clear and well-seasoned material employed by the older experimenters, he takes his beams just as they come from the lumber-yard. In fine, the experiments now being carried on are as far as possible under the real conditions of practice, and not under the imaginary conditions of the closet. The result of these experiments will put into the hands of the engineer far better data for fixing the dimensions of the important structures on which our lives depend than we have before possessed. — G. L. V. [103

CHEMISTRY.

Reproduction of the osmides of iridium. — By heating iridium with iron pyrites, M. Debray obtained it in octahedrons of the regular system, which were removed from the sulphide by dissolving out the latter with hydrochloric acid. Mixtures of iridium and osmium treated in a similar manner gave regular octahedrons which resembled in all respects the natural osmides. The natural osmides are thus shown to be isomorphous mixtures, crystallizing probably in the regular system. — (*Comptes rendus*, xcv., 879.) C. F. M. [104

Thorite and the equivalent of thorium. — In a variety of thorite recently discovered at Arendal in Norway, L. F. Nilson finds a large percentage of iron, lead, and uranium, the latter in the form of dioxide. To separate thorium from cerium oxide, after precipitating the oxalates they were converted into sulphates, and advantage was taken of the slight solubility of hydrous thorium sulphate at 0°. In determining the atomic weight of thorium, the purified sulphate $Th\,(So_4)_2.\ 9\,H_2O$ was ignited at first gently to expel the crystal water, then to a glowing white heat until the acid was driven off. As a mean of ten determinations calculated from the residue $Th\,O_2$, the value 235.43 was obtained. The metal was prepared in nearly the theoretical quantity by igniting potassium thorium chloride mixed with a few grms. of salt, and covered with sodium in a tube filled with salt. When heated in a current of chlorine gas, the metal is converted into the chloride. It unites readily with bromine and iodine, and is easily soluble in acids. Under no conditions does it decompose water, nor is it attacked by alkaline hydrates. — (*Berichte deutsch. chem. gesellsch.*, xv., 2519.) C. F. M. [105

Modification of the law of isomorphism. — An examination of the isomorphous metatungstates and tungstoborates, by D. Klein, led to results which could not be explained by the law of Mitscherlich. A better interpretation was found in a modification of the latter part of this law, first proposed by M. de Marignac. "Isomorphous bodies either have a similar chemical composition, or they consist *chiefly* of the same group of elements or of groups with identical chemical functions." — (*Comptes rendus*, xcv., 781.) C. F. M. [106

Electrolysis of hydrochloric acid. — In the electrolysis of hydrochloric acid, using platinum electrodes, D. Tommasi finds that the heat absorbed in decomposing two molecules of the acid amounts to 78.6 cal. Since platinum chloride was found in solution, a certain quantity of the electromotive force (not determined) must have been absorbed in its formation. One Daniell's cell ($E = 49$ cal.) with one zinc-cadmium element ($E = 16.6$) decomposed the acid, but no chlorine appeared at the positive pole. With two Daniell's cells, bubbles of an oxide of chlorine were observed. When dilute hydrochloric acid (1 conc. acid : 20 H_2O) was subjected to electrolytic action, the liquid at the positive pole became yellow and exerted a strong bleaching action. M. Tommasi regards this action as due to the formation of hypochlorous acid which attacks the electrode in the concentrated acid solution. — (*Comptes rendus*, xcv., 689). C. F. M. [107

Changes of volume and of molecular arrangement in hydrous salts. — An unequal expansion of the alums when heated led E. Wiedermann to con-

clude that a molecular re-arrangement (*umlagerung*) takes place below 70°. Different volumes of the salt Mg. SO_4 6 H_2O at 93° and 50° point to a new modification at 93° since Marignac determined its composition at 50°. The salt Zr $SO_4 . 6 H_2O$ also shows a difference in volume at 40° and 69°. — (*Ann. phys. chem.*, n.f., xvii., 561.) C. F. M. [108

METALLURGY.

A great feat in metal-working. — Messrs. Kloman rolled a steel strip 6 in. wide, ¼ in. thick, and 310 ft. long, at their mill at Allegheny. They have contracted with the U. S. spring car motor construction company for an unlimited number of these steel springs. This company had previously applied to all the large English and continental works, and to other American works, without finding any one ready to undertake the work. — (*Iron*, Nov. 17, 1882.) R. H. R. [109

Molecular condition of metals. — Kalisher has found that sheets of most metals may be rendered crystalline by heat. A zinc sheet will become crystalline at 307° F.: tin and cadmium at 392° to 536°. Most metals obtained by electro-metallurgy give the same result. — (*Iron*, Dec. 8, 1882.) R. H. R. [110

Steel-iron. — M. Keil has succeeded in producing a welded metal which is stated to possess the characters of both iron and steel. It is prepared by pouring the fluid steel on one side of a partition in a mould, and fluid wrought iron on the other: the partition is made of such thickness that it will weld by the heat of the added fluids. This so-called steel-iron is said to have been prepared in five ways: 1°, steel by the side of iron; 2°, steel between two layers of iron; 3°, iron between two layers of steel; 4°, a core of steel surrounded by iron; 5°, a core of iron surrounded by steel. — (*Iron*, Dec. 15, 1882.) R. H. R. [111

Compression of metals. — An improved method of treating all kinds of metals and alloys has been patented by Mr. Louis Clemandot of Paris; it consists in subjecting them, when raised to a temperature sufficiently high to insure the necessary ductility, to powerful compression, and then allowing them to become completely cool while still under pressure. An increased density and hardness is claimed for metals thus treated. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [112

MINERALOGY.

Axinite. — Crystals of this mineral from near Bethlehem, Penn., have been studied by B. W. Frazier. He endeavors to show the resemblance in crystalline form between this mineral and datolite. Placing the crystals in position so that the zone *p*, *l*, and *u* shall be parallel to the vertical, *p*, *m*, and *r* to the macrodiagonal, and *y*, *m*, and *b* to the brachydiagonal axes, the following relations are obtained from v. Rath's measurements: —

$\breve{b} \wedge \acute{c} = a = 81° 56' 59''$	$O \wedge i\breve{i} = A = 82° 09' 48''$
$\breve{a} \wedge \acute{c} = \beta = 91° 51' 28''$	$O \wedge i\bar{i} = B = 90° 04' 21''$
$\breve{a} \wedge \bar{b} = \gamma = 102° 52' 14''$	$i\breve{i} \wedge i\bar{i} = C = 102° 44' 18''$

$$\breve{a} : \bar{b} : \acute{c} = 1 : 1.56003 : 0.48742$$

The corresponding for datolite are

$$\beta = 90° 06' \qquad O \wedge ii = B = 90° 06'$$

$$\grave{a} : b : \acute{c} = 1 : 1.5712 : 0.49695$$

Besides the relation in axial lengths and angle β, a still closer relation is shown in the angles between corresponding planes. The author also calls attention to the similarity in crystalline form between datolite and calamine, — the latter having the axial relation, $\breve{a} : \bar{b} : c = 1 : 1.5564 : 0.47657$, — and their similarity in composition, datolite being H B Ca Si O_5, calamine $H_2 Zn_2$ Si O_5. He can, however, show no relation between their composition and that of axinite. — (*Amer. journ. sc.*, Dec., 1882.) S. L. P. [113

Saussurit. — By means of microscopical investigation, A. Cathrein has shown that this mineral is composed of numerous microlites of zoisite in a ground mass of feldspar. He also shows, by calculation from various analyses and optical examination, that the mineral has been derived from plagioclase, more seldom orthoclase, by a loss of silica and alkalies, and taking-up of lime, iron, and water; and that thereby the minerals zoisite and epidote have been formed, giving rise to the microlites, which with the remnant of feldspar make up the mass. — (*Zeitschr. kryst.*, vii. 243.) S. L. P. [114

Danburite. — This interesting mineral, of which such beautiful examples have been described by Professors Brush and Dana from St. Lawrence County, N.Y., has been lately discovered at Scopi, in Canton Graubünden, Switzerland, and fully identified and described by C. Hintze. The crystals occur in prisms 2–15 mm. long, ½–3 mm. broad; are colorless to wine-yellow, and brilliant. The author gives the results of crystallographic measurements, which agree very closely with those obtained from the American crystals with some additional new planes. In habit the crystals vary much from the American. As terminal planes, the pyramid (142), often occurring alone, and macrodome (101) are most frequent. The base, which never fails on the American crystals, was but once observed, and then as a doubtful crystal plane. The prismatic zone appears very much striped. On account of the abnormal size of one of the dome-planes or two adjacent pyramidal planes, the crystals often have a decided monoclinic appearance. The optical properties coincide with those of the American variety. — (*Zeitschr. kryst.*, vii. 296.)

The above mineral has been analyzed independently by C. Bodewig and A. Schrauf, giving results which are wholly in accordance with the analyses of the American mineral. C. Bodewig's analysis gave Si O_2 48.66, Ca O 22.90, $B_2 O_3$ 28.09, $Fe_2 O_3$ 0.23, $Al_2 O_3$ 0.08 = 99.96. — (*Zeitschr. kryst.*, vii. 391.) S. L. P. [115

GEOLOGY.

Lithology.

The trachytic rocks of Tokay, Hungary. — Professor Szabó gives in this paper the outlines of his new classification of trachytic rocks, the term trachyte covering for him about as extended a range as the term 'greenstone' used to do. His divisions are as follows: —

A. TRACHYTE WITHOUT BIOTITE.

I. *Augite-trachyte;* with anorthite-bytownite, without biotite or quartz. Olivine very rarely found.

II. *Amphibole-trachyte;* with labradorite-bytownite, augite rarely entirely absent. Quartz wanting.

B. TRACHYTE WITH BIOTITE.

III. *Micaceous-amphibole-trachyte;* with andesite-labradorite; with or without quartz, augite, and garnet.

IV. *Micaceous-amphibole-trachyte;* with oligoclase-andesite, with or without quartz and augite.

V. *Micaceous trachyte;* with orthoclase-oligoclase, with or without quartz and amphibole. Augite rarely absent.

The micaceous trachytes are regarded as older than

the others. The paper contains a discussion of the geological relations of the trachytes in general.

The Tokay rocks are the following: 1. Augite-trachyte. 2. Amphibole-trachyte. 3. Micaceous-quartz-trachyte. 4. Conglomerates and trachytic tufas. 5. Red plastic clay. 6. Prehistoric and recent alluvium.

The microscopic, chemical, and geological characters of the rocks are given, with a discussion of their former nomenclature. — (*Assoc. franç. avanc. sc.*, x. 532.)

In this connection attention may be drawn to two other papers by the same author, relating to the classification of the trachytes: Classification macrographique des trachytes (*Bull. soc. géol. France*, Dec. 7, 1881); and Die makrographische eintheilung der trachyte. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 166.) M. E. W. [116

A new basaltic rock. — The name pyroxenite is given by Dr. C. Dölter to a rock from the Cape Verde Islands, composed of augite, magnetite, and a glassy base. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 140.) M. E. W. [117

METEOROLOGY.

Ohio state weather service. — This service, recently organized, has begun the publication of monthly reports. The November issue contains returns from nineteen stations, including five maintained by the U. S. Signal Service, accompanied by a well-arranged monthly summary. — W. U. [118

Observations at high stations. — The Austrian meteorological service established in 1880 self-recording instruments at Klagenfurt and Obirgipfel, stations situated near each other geographically, but having altitudes of 438 and 2,044 met. respectively. Hourly observations to the end of the year 1881 have been recently published, embracing those of pressure at both stations and of temperature at Klagenfurt only. — (*Jahrb. k.-k. centr. anst. meteor.*, 1882.) W. U. [119

Rainfall statistics. — Systematic observations of rainfall throughout France are made by the Bureau central meteorologique. The results for 1880, deduced from 1,291 stations, have been collected and studied by M. Th. Moureaux, who publishes twenty-five charts in illustration: eight of these are designed to exhibit the connection between rainfall and barometric depressions, and confirm the opinion advanced by Prof. Loomis from his studies of the U. S. weather-maps, that rain is most abundant in advance of a depression, and that therefore the direction in which a storm will move can be foretold by the distribution of the rain areas. (*Sur le régime des pluies en France pendant l'année* 1880.) Mr. Symons, through whose efforts more than 2,000 stations in Great Britain have been established, has published valuable suggestions for securing uniformity of practice among rainfall observers. — (*Symons' meteor. mag.*, Dec., 1882.) W. U. [120

Floods in France. — Camille Flammarion describes the year ending with November, 1882, as one of very numerous rainy days, although of normal rainfall, in France. In Paris the rainfall at the Montsouris observatory was 543 mm., closely agreeing with the average of other years: but the number of rainy days was 208, and besides these, 100 more were cloudy. As a result, summer evaporation, which ordinarily disposes of much of the rainfall, was this year very ineffective; the ground became saturated, and when the November rains (113 mm.) came, the rivers rose rapidly throughout the country. — (*Le Voltaire*, Paris, Dec., 1882.)

Th. Moureaux gives further account of the rising of the Seine early in December. — (*La Nature*, Dec. 23, 1882.) W. M. D. [121

Auroras. — An extensive catalogue of auroras observed in Sweden from 1800 to 1877 has been published by R. Rubenson, director of the meteorological institution of Sweden. It forms the second part of the catalogue of auroras observed since the sixteenth century. The appendix contains descriptions of the auroras, and tables of the annual variation in frequency, and the years of maxima and minima. — (*Cat. aurores bor. observ. en Suède, 16th cent.* — 1877, part 2.)

Mr. J. Rand Capron calls attention to the fact, that the auroral display in November was followed by first a cold and then a warm wave. The doubt raised as to the character of the supposed auroral beam, which was observed in England, and from which the height of the aurora has been calculated, is removed by the statement that it gave the auroral spectrum. — *Nature*, Dec. 28, 1882.) W. U. [122

GEOGRAPHY.

(Arctic.)

Theory of an open polar sea. — Mr. George R. Howell, of the New-York state library, read a paper favoring this theory. He remarked that the field of new exploration is rapidly narrowing to that of the north polar region. Among the reasons for the open-sea theory are: —

1°. Water-fowl go regularly each spring northward from Greenland for nesting. As the ice-barrier from 73° to 82° is too cold for birds to raise their young, their nesting-places must be north of this barrier, and in a milder climate. 2°. The occurrence of warm winds from the circumpolar regions, as verified by explorers in high latitudes. 3°. The occurrence of furious gales during the long arctic winter, which would be unaccountable if the region for ten degrees around the pole were as cold as the zone of the ice-barrier, and therefore as calm as the equatorial belt. 4°. Morton and Hayes both saw open water in Kennedy channel as far as the eye could reach northward.

Mr. Howell spoke of the agency of the gulf stream, which is commonly regarded as limited to the latitude of Spitzbergen. His own belief and theory is, that the waters of the gulf stream have a greater specific gravity than those surrounding the ice-barrier, for two reasons: first, the immense rain and snow fall of the arctic regions must freshen the water and make it lighter; and, second, water is lightest near the freezing-point. The comparatively warm water of the gulf stream dips and passes northward under the ice-barrier, and emerges, with velocity reduced by corresponding currents from the opposite side of the pole, into the comparatively warm polar sea. The same cause would produce an ascending current of warm air, to exert a marked influence upon the atmospheric currents of the whole northern hemisphere. Such in brief is the normal system of water and air currents, according to the theory of the speaker, whose paper was listened to with special interest. — (*Albany inst.; meeting* Jan. 16.) [123

Sea-otter hunting. — The sea-otter hunting in the Kurile Islands, now Japanese territory, has been chiefly farmed out to foreigners as a government monopoly. It is now proposed to form a Japanese company for the purpose of carrying on the business on a larger scale than hitherto. The pelts of Enhydra marina are the most valuable furs known, and the animal is found only in the Kuriles and Alaska in any numbers. — W. H. D. [124

British co-operation in arctic meteorological and magnetic research. — Letters have recently been received from Capt. H. P. Dawson, R.A., who has been appointed to undertake the work of establishing one of the chain of circumpolar observing stations in the scheme of the international commission, originally suggested by the late Lieut. C. Weyprecht. During the past summer Capt. Dawson, with two observers and an artificer, started for the Hudson Bay Territory with the idea of establishing a station at Fort Rae or Fort Providence on Great Slave Lake. Funds for the expedition to the amount of $12,500 were guaranteed by the government, $5,000 by the Royal society, and the Canadian government has since added the sum of $4,000. It is supposed that this will suffice to keep the party in the field for at least two seasons. When last heard from, all were well, though somewhat late in reaching their destination. It was not certain at last accounts whether one of the posts above mentioned, or old Fort Simpson, would be decided upon; the last-mentioned offering several advantages not shared by the others, though on some accounts less desirable. — W. H. D. [125

(*South America.*)

Early exploration of the Amazon. — The reprint of P. Texeira's voyage up the Amazon (1637–1638) is continued. — (*Bol. soc. geogr. Madrid*, xiii., 1882, 266–275.) W. M. D. [126

Bolivian table-land. — The plateau southward from Lake Titicaca was explored and surveyed during a part of 1882, by J. B. Minchin, for the Bolivian government. Its altitude is 12,000 or 13,000 feet, with generally level surface, broken by isolated hills and smaller ranges. On the east, the Cordillera Real, or main chain of the Andes, is composed chiefly of stratified rocks, rising to great heights, and culminating in Sorata and Illimani. On the west, the Coast Range is largely volcanic, with some vents still active. Both ranges are metalliferous. The eastern range has copious rains and an ample plant-growth; the western is dryer and almost barren. The Desaguadero, or outlet of Lake Titicaca, flows along the eastern side of the plateau, over low, flat land, very boggy in the wet season, into Lake Poöpó or Aullagas, about 50 by 15 miles, but with low banks and variable area. From its south-western angle an outlet, the Laca-Ahuira, carries off what is not lost by evaporation. This stream flows underground for three miles of its course, and farther west is lost in the Salinas de Coipasa, which receives several other rivers, some fresh (Llauca, Isluga), some brackish (Sabaya, Cariquima): these salinas are about 400 square miles in area, and of dazzling white surface. A little to the south-east begin the great Salinas de Garcimendoza, with an area of 4,000 square miles, a white and perfectly level sheet of salt, three or four feet thick; in the dry season it can be crossed on horseback. The former area of the lake from which these salinas remain is estimated at 20,000 square miles; its old shore-line is marked by a persistent level calcareous incrustation, 200 feet above Lake Poöpó. — (*Proc. geogr. soc. Lond.*, Nov., 1882, map.) W. M. D. [127

(*Europe.*)

Southern Russia. — J. Garnier gives an interesting account of the region about the river Donetz, visited at the end of 1881. Rocks of the coal-measures give a gentle relief to the surface, the greatest difference found between valley and hilltop being only 150 met.; but the surrounding country is more even, a part of the great plain extending to the Arctic Ocean. The climate is consequently variable; very cold and snowy in the winter season, which begins in October. The rivers and the Sea of Azoff are frozen about four months. A quick change gives warm weather in May, and a fresh vegetation springs up; but the summers are so dry and hot that the harvests often fail. Irrigation cannot be practised, as the streams run in valleys 40 or 50 met. below the general surface. Roads are very bad, except when smoothed over with snow. The peasants pitied the French people who had some winters without snow! Towns are few, and the population is so sparse that the fields are often cultivated only once in three years. Trees are absent, except occasionally on the river-bottoms, and wood is too dear to be used for fuel. The absence of forests is the result, according to Le Play, of the severe climate; Hommaire de Hell says tree-roots cannot penetrate the compact soil; the Cossacks themselves believe the trees have been cut away and not replanted. In spite of many unfavorable conditions, years of good harvest yield immense quantities of grain for exportation. Coal forms an undeveloped resource of the country. It was discovered in the time of Peter the Great, and has lately been studied under the direction of Helmersen; but in spite of its great quantity and excellent quality, it was hardly worked till after the Crimean war; then the better steam navigation of the Black Sea, and the beginning of railroad construction in Southern Russia, gave a new impulse to mining, and in 1881 1,600,000 tons were raised. Still English coal is found in all the ports of the Black Sea. This is largely because the coal from the Donetz mines has no good harbor for export, for the Sea of Azoff is but 4 met. deep at its entrance, the Strait of Kertch; and at Taganrog, its most important port, now connected by rail with the mines, vessels drawing only 3.5 or 4 met. must anchor 25 kil. from the shore, and load or discharge by double transfer to cart and lighter. Although possible with wheat, this is too expensive for coal. The harbors might be much improved by dredging. — (*Bull. soc. géogr. Paris*, 1882, 498.) W. M. D. [128

(*Asia.*)

Across Eastern Gobi. — Hermann Mandl, a young German, who went to try his fortunes in the East, spent two years learning Chinese at Peking, and was then engaged, in 1880, as interpreter by Gen. Zo-zung-tang, who was about to lead an army across the desert to Hami in view of possible difficulty with Russia concerning the occupation of Kuldja. Lieut. G. Kreitner, who had been as far as Ansifan two years before, gives a sketch-map and account of Mandl's expedition from Ansifan across Gobi to Hami, and compares it with the description of the same region in 1875 by Major Sosnowski (*Journ. roy. geogr. soc. Lond.*, 1877, 160). Ansifan is in 95° 56′ 50″ long. E. of Gr., and 40° 31½′ N. lat., at an elevation of 1,144 met., on a fertile plain watered by the Sula-ho, which rises in the snowy Nan-san on the south, and flows westward into the desert, ending in the reported Kara-nor. The city suffered greatly in the rebellion of 1868, as did many neighboring towns, and has now only a thousand inhabitants, many of its houses being empty. Kua-Tchou, some twenty miles west-south-west, was at this time completely destroyed, though it still appears on most maps as an important place. On the 26th of July, 1880, Mandl left Ansifan. His party travelled at night to avoid the excessive heat, — the thermometer had registered 107° F. before starting, — and was eleven days on the way, averaging fifty miles to a march. The loose sand of the flat desert, and the rough stony paths over the occasional hills, which sometimes rise 120 feet above the plain, made travelling extremely dif-

ficult; the resting-stations were miserable places, often supplied with bad water from their springs. A few antelope were seen on the way.

Zo-zung-tang's army consisted of 2,500 men, who crossed the desert in divisions of 500 so as not to exhaust the water-supply on the way: they had not been paid for ten months, and their plundering made their advance like an enemy's invasion. But at Hami the people rejoiced at the coming of the holy general, for since his arrival it rained as it had not for a long time before. Moreover, he had posted orders that all brawlers and opium-dealers should be beheaded, all impostors should be punished with 3,000 lashes and should then have their ears bored with a lance, and he advised the people to let the soldiers have nothing till they had paid for it. Hami lies at the southern foot of the eastern extension of the Tian-san, at an elevation of 960 met., with a broad, well-watered pasture-land stretching thirty miles before it to the desert. Its population is 1,500–1,800 (Sosnowski said 10,000) besides a garrison of 3,000. [On Stieler's Atlas, sheet 64, 1881, *Ansifan* is given as *Ngansi Fan tcheu*, and is placed in latitude 39° 40′, or more than 50 miles too far south according to these data.] — (*Peterm. mitth.*, 1882, 416, map.) W. M. D. [129

Russo-Persian boundary and Merv. — F. v. Stein gives a map and description of the most recent work on the region stretching eastward from the southern end of the Caspian toward the oasis of Merv. A railroad was completed in 1881 from Michailow on the Caspian, south-easterly to Kysyl-Arvat (about 130 miles); and it is now proposed to extend this along the inhabited strip of land between the Kopet Mountains and the Kara Kum (desert) to Askhabad, and perhaps to Seraks on the Tedjend (Heri-Rud river). With this object the Russian engineer Lessar has examined the route, and finds it one of very easy grades and construction, for the transition country between mountain and desert is very flat throughout. Levelling showed a depression below the level of the Caspian, about midway on the present railroad; and this is suspected to continue eastward, in which case the Tedjend and Murgab could not in former times have reached the old course of the Oxus, but must after their junction have flowed to the Caspian independently: now they are both lost in the sands of the Kara Kum. The people along the surveyed line gladly accept the present Russian and Persian government of their country, as a guard against the robbing Tekke tribes. The forts or walled towns contain a single street for the bazaars; from this, crooked, narrow, dirty alleys, often shut apart by doors, lead among the mud-huts, the only kind of habitation. In the fields at a distance from the forts, are scattered watch-towers with entrances so small that one must creep through them: the laborers hid themselves in these, blocking up the doorway, on the first appearance of a band of Tekke robbers, and there waiting till they had passed by. In the present better times, the towers are not needed. The former population must have been much larger than the present, for ruins are numerous; but the people have no traditions about their builders. Fields are cultivated only where irrigated; and on the larger rivers, Tedjend and Murgab, dams are constructed to feed numerous branching canals. The districts thus cared for have been much reduced in area in consequence of the plundering of the Tekke bands: the people have been driven off, and the canals are fallen into decay. [The question of the less supply of water is not considered.]

The oasis of Merv, as described by O'Donovan, an English 'correspondent,' contains a dense population, variously estimated from two to five hundred thousand, gathered in numerous villages, but without any central city. Since 1857, it has been in the power of the Tekke-Turcomans, who were then driven from Seraks on the Tedjend by the Persians. They are hospitable; but they are also cruel, deceitful, lying robbers. The men are poor workers; but the carpets, silks, and especially the silk embroideries, made by the women, are celebrated throughout Central Asia. The oasis is watered by the Murgab, which is raised by a dam, then divided into two arms, these into forty-eight branches, and finally into hundreds of canals: all these are under the control of the Tekke, who rent their use to the under tribes of the district. The possibility of Russian advance to this point is a question of much importance for the future of Central Asia. — (*Peterm. mittheil.*, 1882, 369, map.) [In this connection may be mentioned the accounts of Lessar's explorations in *Proc. roy. geogr. soc.*, iv., 1882, 486; v., 1883, 1; and of O'Donovan's, *id.*, iv., 1882, 345; and his book, The Merv oasis, London, 1882.] W. M. D. [130

BOTANY.

(Structural and physiological.)

New apparatus for respiration experiments. — This consists of a measured flask holding upon moist paper the seedlings under examination, and connected with a supply of oxygen in a balanced eudiometer. The evolved carbonic acid is absorbed by potassic hydrate in a small receptacle suspended within to the cork of the flask. The amount of oxygen consumed can be read off on the balanced eudiometer, which sinks in a bath of mercury as its contents disappear; the carbonic acid produced is ascertained from the potassic carbonate, and from subsequent treatment of the air in the flask at the close of the trial, by means of baric hydrate. A possible objection to this apparatus is the fact, that some time must elapse after it is arranged before the temperature of the flask and eudiometer can be precisely that of the surrounding air. Professor Godlewski has, however, found this error to be in point of fact unimportant. — (*Bot. zeit.*, Nov. 24, 1882.) G. L. G. [131

Basipetal development of leaves. — Trécul gives an account of the sequence in which the first vessels appear in Cruciferae, asserting that thereby his views as to the basipetal development of leaves are confirmed. — (*Comptes rendus*, Dec. 4, 1882.) G. L. G. [132

The structure of the leaves of heath. — Ernst Ljungström divides the species of Erica into four groups depending on the shape and microscopic anatomy of the leaves. Three types are, E. cupressina, E. stricta, and Calluna vulgaris. A fourth group comprises most of the Ericae proper. — (*Bot. notiser*, 1882, 178.) G. L. G. [133

Dispersion of Utricularia intermedia. — A few plants were thrown into a swamp at Oeleghem (Belgium) where the water was shallow. By the following year the species had covered several ares. Last March, M. Gilbert observed on the surface of the water minute vesicles blown hither and thither by the winds, and so abundant in amount as to have the appearance of green velvet. These proved to be detached bulblets of Utricularia intermedia formed of whorls of rudimentary leaves on an extremely short axis (see Gray's Manual, under Utricularia). After the development of the axis the air, hitherto entangled in the leaves, escapes, and the bulblet sinks to the bottom, where it speedily develops roots. M.

Gilbert notes also that this plant is also dispersed through the agency of the larvæ of caddisflies (a common bait used by anglers). The larvæ have an envelope composed of minute shells, bits of dead wood, fragments of plants, etc.; and sometimes this artificial carapace is furnished with five or six bulblets of Utricularia. These are borne about by the larvæ until at an early stage of growth they become detached from them, and then they take root in the earth at once. — (*Bull. soc. roy. bot. Belg.*, Dec. 28, 1882.) G. L. G. [134

Fertilization of Gerardia pedicularia. — Professor Bailey, who has already published several observations on the perforation of the flowers of this species by predatory humble-bees, has found that when few of these insects visit the flowers they are not so apt to perforate them. He concludes, with Fr. Darwin, that they only puncture flowers whose nectar they can reach normally, when competition forces them to work very rapidly. — (*Amer. nat.*, Dec., 1882.) W. T. [135

Spring floras. — The influence of temperature has been applied by Dr. Taylor to the explanation of vernal floras. Species that bloom early are frequently identical with, or closely related to, alpine species of the same latitude; and these, as is well known, bear a similar relation to arctic species. Alpine and arctic floras are commonly explained as remnants of the post-glacial flora, which have survived in consequence of the protection afforded by the cold of high altitudes or latitudes. Spring flowers are claimed to receive similar protection by their time of flowering. It is a suggestive fact, that when our early-flowering species also occur at high elevations, or farther north, they bloom much later than with us. — (*Nature*, Nov. 2; *Science gossip*, Dec., 1882; *Bot. gaz.*, Dec., 1882.) W. T. [136

Fall blooming of Menyanthes trifoliata. — This plant was found blooming abundantly in Rhode Island on the 23d of October, by Prof. W. W. Bailey. The swamp in which it grew had been desiccated by a long summer drought, which seems to have had upon it the effect of its normal winter rest, so that the following autumn rains and continued warm weather induced a season of general and vigorous bloom. — (*Coult. bot. gaz.*, Dec., 1882.) S. W. [137

(*Systematic and general.*)

Jamaica ferns. — A critical examination of the Jamaica ferns in the herbaria of the British museum and Kew, by G. S. Jenman, results in the addition of eight new species, with some not before credited to the island, and corrections in previous determinations. — (*Journ. bot.*, Nov., 1882.) S. W. [138

New American composite. — E. L. Greene redescribes from fuller material his proposed new genus, Holozonia, intermediate between Lagophylla and Hemizonia, of a single species (H. filipes), found in mountain streamlets east of Napa Valley, California. — (*Torr. bot. bull.*, Dec., 1882.) S. W. [139

Forest-trees of the gulf region. — A similar but more detailed account of the more important forest-trees in the States bordering the Gulf of Mexico, by Dr. Charles Mohr. — (*Ibid.*) S. W. [140

Origin of Cassia lignea. — The cassia districts of southern China have been recently visited by Mr. Ford; and the tree which is found to be cultivated there for the supply of Chinese cinnamon, or the cassia-bark of commerce, Professor Dyer of Kew identifies with the Cinnamomum cassia of Blume. An account of its cultivation, the preparation of the bark, etc., is given. — (*Journ. Linn. soc. Lond.*, Dec., 1882.) S. W. [141

ZOÖLOGY.

Coelenterates.

Nature of the green cells of Hydra. — The question whether any animals are able to produce chlorophyl is now attracting considerable attention; and as Geddes and others have stated that such animals as Hydra and Spongilla do have the power to vegetate their own intrinsic chlorophyl, Dr. Otto Hamann has made a careful examination of the manner in which the green cells make their appearance in the egg of Hydra. From the study of sections through the ovarian ovum at successive stages of development, he concludes that the green bodies are not developed in the egg, but that they make their appearance suddenly, and are full-grown as soon as they are found at all; that they migrate into the ovum, through the supporting layer from the endoderm. He thinks that the bodies which Kleinenberg described in the egg, as the early stages of the green cells, are in reality early stages in the development of the pseudo-cells.

Besides examining sections, he has removed the green cells from the body of the hydra, and has cultivated them in water; and he finds that when thus treated they thrive and multiply, and are apparently under conditions of life which are as natural as those to which they are exposed in the cells of the animal. They multiply rapidly in both cases by repeated division into fours. He states, on the authority of Dr. Dalmer, that the green bodies of Spongilla and Paramarcium also multiply by division into fours, and that they will thrive and multiply, like those of Hydra, in water. From these reasons, as well as from the fact that they are not formed by the egg of Hydra, but migrate into it, and from the fact that they have a cell-wall and nucleus, he concludes that they are algae; and he therefore accepts Brandt's conclusion, that, in every case where chlorophyl is present in animals, we have to do with unicellular algae, which are both morphologically and physiologically independent.

Brandt's statement that a green Hydra, when placed among specimens of the brown Hydra, inoculates them with its alga, and thus converts them into its own species, he disputes, on the ground that his own experiments in this direction failed, and also for the reason that the two forms are distinguished by many specific characteristics which have nothing to do with the presence or absence of the green bodies. He also doubts the propriety of giving specific names to these algae at present.

As regards the relation between the alga and its host, he believes that the Hydra derives no particular benefit from the oxygen given off by the algae, although it may digest them. He does not regard the alga as in any way dependent upon the Hydra. — (*Zeitschr. wiss. zool.*, xxxvii. 457.)

A directly opposite view regarding the nature of the green bodies of Hydra is advocated by William Marshall, who concludes, from the fact that they remained without change in a Hydra which was kept in the dark for six weeks, that they are not algae but are characteristic of the animal itself. He regards the green color of Hydra viridis as a protective resemblance to the fresh green plants among which it lives. — (*Ibid.* 665.) W. K. B. [142

Interesting observations on Hydra viridis. — The paper last noticed contains a number of facts regarding this species, which, although they are not strictly new, have never received due attention. Marshall has verified Baker's observation, made 140 years ago, that, when a parent Hydra is injured, one of the

buds may develop into a parent stock, while the original parent becomes separated, as a bud, from the body of its own offspring. He has also verified Trembly's discovery that Hydra sometimes multiplies by tranverse fission. He has rediscovered the so-called *anus*, which was described by Folkes in 1742, and by other observers of the last century. It is in no sense an anus, but simply the remnant of the channel of communication between the digestive cavity of the bud and that of the parent.

Baker's discovery, in 1744, that the two tentacles which first appear in the bud lie in the plane which passes through the axis of the body of the mother, has recently been verified by Mereschkowsky. Marshall not only finds that this is the case, but that the reproductive organs appear in the same plane. He also finds that when the tentacles of a full-grown specimen are cut off, the two which are first re-developed lie in this same plane. He therefore concludes that Hydra is in a certain sense, a bilateral animal.

His attempts to repeat Trembly's experiment of reversing a Hydra, failed completely, like those made by Baker and others; but a Japanese naturalist, Prof. Mitsukuri, has recently been more successful, and has verified Trembly's statement.

Marshall concludes that Hydra is, in a certain sense, both a hydroid polyp and a Scyphostoma. — (*Zeitschr. wiss. zool.*, xxxvii. 664.) W. K. B. [143

Anatomy and histology of Cyanea. — Dr. Lindenfeld gives a minute and profusely illustrated account of the general anatomy and the histology of a new species of Cyanea (C. Annaskala) from southern Australia. The paper is Part I. of a monograph on the Coelenterata of the South Sea. — (*Zeitschr. wiss. zool.*, xxxvii. 465.) W. K. B. [144

Mollusks.

The organ of Bojanus of the oyster. — Mr. P. P. C. Hoek, of the zoölogical society of the Netherlands, has recently published his investigations upon the generative organs and the organ of Bojanus of Ostrea edulis L., as observed by him at the zoölogical station of the society in Bergen-op-Zoom on the Escaut. He finds it to open into the pericardiac cavity, and also communicates with the generative openings on either side. Its principal cavity is a wide canal clothed with epithelial cells bearing very long cilia, communicating with numerous surrounding smaller cavities formed by induplicatures of membrane. This is believed to be its glandular portion. It lies close against the ventral side of the adductor, and extends into the substance of the mantle laterally. — (*Comptes rendus*, Nov. 2, 1882.)

The present writer, in the course of his investigations into the anatomy of O. virginica Gmel., has found a somewhat similar paired organ below the great double adductor. On either side it is partially embedded in the mantle; crescent-shaped, as seen from the side; frequently marked by brownish tissue in its walls; about five-eighths to three-fourths of an inch long, and a sixteenth to an eighth of an inch in width at its widest portion. In sections through this organ and the adjacent tissues of hardened specimens, the following details are revealed: A number of large central canals, clothed internally with epithelium bearing very long cilia, and communicating with smaller tubular cavities of irregular form, or with somewhat folded walls, lined with epithelium bearing shorter cilia. The inner non-glandular part embraced the parieto-splanchnic ganglia, sections of which appear in some of the preparations. The connection of the organ with the generative openings and pericardiac cavity was not traced. There can be little doubt but that what M. Hoek and myself have seen is really the renal organ of these animals. — J. A. R. [145

A remarkable molluscan type. — An interesting discovery has been made during a study by Mr. Dall of the deep-sea mollusks dredged off the Antilles by the U. S. coast-survey steamer 'Blake,' under the supervision of Prof. A. Agassiz. A living species of the genus Dimya Rouault is found attached to the margin of dead shells. This genus is fossil in the eocene of the Bos d'Arros, France, a deposit equivalent to that of the Paris basin. The type and sole recognized species until now was first figured by D'Archiac as an Anomia; and, in the same year, its true characters were recognized by Rouault. Since then the genus has attracted little attention, being barely mentioned in general treatises. It is traceable continuously through the formations on the Mediterranean, from the eocene to the pliocene; Ostrea tenuiplicata of Seguenza turning out to be a Dimya, closely allied to the original type of Rouault, to which, however, the recent form from the Antilles is still more similar, — indeed, practically identical. The interest of the discovery does not, however, lie chiefly in its ancient lineage, but rather in the remarkable characters of Dimya. It is practically an oyster, with two adductor muscles, and a pearly *outside* to its shell. It combines in itself features supposed to be characteristic of different orders of mollusks, and many separate groups within those supposed orders. The outer layers have a silvery nacre as in some oysters, like which Dimya has a porcellanous inner layer. The hinge has a pit like Hinnites or some pectens, roughened in one species as in Pseudamussium Verrilli. The branchiae are of a very primitive type, consisting of long disunited filaments attached to a cord-like band, forming a living fringe. Other and still more peculiar features require more study. It would seem as if the definite establishment of this genus gave the *coup-de-grâce* to the old order Monomyaria. — W. H. D. [146

Worms.

Structure and development of Dinophilus (a turbellarian). — Dinophilus is a marine rhabdocoelous planarian, resembling externally an annelid larva. A new species (D. apatris) was found in the marine aquarium of the zoölogical institute at Freiburg-im-Breisgau, and forms the subject of a valuable paper by Dr. Korschelt. The female is some thirty times larger than the male; is developed from large eggs, while the male is developed from a small egg. The structure of the female is described in considerable detail, especially as regards the histology. The most characteristic features of the female are the two bunches of setae on the front of the head, the constriction forming a neck, the five rings of cilia around the body, and the proboscis. This last is a *solid* mass attached to the base of a hollow sheath underneath the pharynx; when retracted the posterior end is bent upwards like the leg of an L. The sheath opens just inside the mouth. The proboscis is composed mainly of striated circular muscles, inside of which are longitudinal muscles. The tip is specially differentiated. The probosics can be thrust out and withdrawn with great rapidity, and probably serves to gather diatoms, etc., on which the animal feeds. It will be remembered that an organ similar in some respects exists in Prostomum, but cannot be regarded as homologous, for it lies above and not below the mouth. The male is not only smaller than the other sex, but shows a rudimentary organization; was observed to live ten days only, while the females were kept alive for months.

In the course of development two polar globules are formed. Segmentation is complete but unequal. There is a well-marked gastrula; the larva is completely formed, except the sexual organs, upon leaving the egg. Korschelt attempts to show a relationship of Dinophilus with the rotifers. (K. labors under several serious misapprehensions as to the characteristics of Rotifera.)—(*Zeitschr. wiss. zool.*, xxxvii. 315).

In a supplementary note he calls attention to the fact that Metschnikoff, in an article on the Orthonectidae (*Zeitschr. wiss. zool.*, 1881, 299), had previously made mention of the sexual dimorphism of Dinophilus. — (*Zeitschr. wiss. zool.*, xxxvii. 702.) C. S. M. [147

Parasites of elephants. — In spite of the importance of elephants as domestic animals, very little is known of their parasites. Cobbold has published a list of the species known at present, with descriptions and annotations. He mentions the following: Ascaris lonchoptera; Sclerostoma sipunculiforme; Strongylus clathratus; S. foliatus n. sp.; S. falcifer, n. sp.: Dochmius sangeri, n. sp.; Filaria Smithii, n. sp.; Amphistoma Hawkesii; A. ornatum, n. sp.; A. papillatum, n. sp.; Fasciola Jacksoni; making eleven species of helminths, besides which there are known three insect parasites, — a bot, Gastrophilus elephantis; a huge louse, Hæmatomyzus elephantis; and a mite, Homopus (Symbiotes) elephantis. The paper closes with a few practical considerations, of a necessarily desultory character, on the parasitic diseases of elephants. — (*Trans. Linn. soc. Lond., zoöl.*, ii. pt. 4, 223.) C. S. M. [148

Insects.

Coleoptera of Cincinnati. — A supplementary list of 167 species is added to the 1,419 of his earlier catalogue by C. Dury. No notes are added. — (*Journ. Cinc. soc. nat. hist.*, v. 218). [149

Rearing Tortricidae. — Some good hints as to the best means of rearing larvae of this group are given by C. G. Barrett; the main secret of course being how longest to preserve succulent leaves from either moulding or withering when removed from the plant. — (*Ent. monthl. mag.*, No. 224.) [150

Transformations of Endotricha flammealis. — An excellent life history of this pyralid moth is traced with care by W. Buckler, the transformations being previously unknown. The eggs are laid in varying situations late in July; the caterpillar, which is strongly given to cannibalism when reared in confinement, hatches early in August, and in September conceals itself, when not feeding, in a singular web; this is partitioned into several chambers, often as many as from three to five, one above the other, openly wrought, the larva occupying different chambers indiscriminately, curled tail over head. The larva generally hibernates, becomes full fed in May, and appears on the wing in July. — (*Ent. monthl. mag.*, No. 223.) [151

Moths of New Mexico. — A list of 98 species collected by F. H. Snow is given by A. R. Grote, with descriptions of new forms, and preceded by some general remarks. He finds an admixture of subtropical forms, with some "representatives of European species not yet found near either our western or eastern seaboards," mentioning particularly a species of Copimamestra. A summary of the characters used in establishing genera in the Noctuidae, the author's special study, is added. — (*Ann. mag. nat. hist.*, Jan., 1883.) [152

Oviposition in Argynnis. — Dr. Henry Skinner called attention to a curious departure from the usual habit of lepidoptera in the case of Argynnis Cybele, which drops its eggs from a height upon grass and violet leaves, instead of depositing them, as in the case of all other species known to him, upon the leaves of the plant upon which the insect is to feed. — (*Acad. nat. sc. Philad.; meeting* Jan. 23.) [153

VERTEBRATES.

Destruction of red blood corpuscles in the liver. — It has long been supposed that the red blood globules were to a great extent broken up in the liver, giving rise, among other things, to the bile pigments. The experimental proof, however, has been unsatisfactory. R. Nicolaides finds on careful enumeration, by Malassez's method, of the corpuscles in blood drawn from the portal and hepatic veins of rabbits, dogs, and cats, that the number is always much less in the hepatic vein. — (*Archiv. de physiol.*, x. 1882.) H. N. M. [154

Electrical irritability of the spinal cord. — Schiff contributes new experiments on this much-disputed point. His general conclusion is, that no directly irritable elements can be demonstrated in the spinal cord, apart from the paths of the nerve-roots. — (*Pflüger's archiv*, xxix. 1882.) H. N. M. [155

Uses of the bile. — From observations made on dogs with biliary fistulae, and carefully prevented from licking up the outflowing bile, F. Röhman concludes that the ill results of excluding this secretion from the intestine have been over-estimated. His animals, when fed on dog-biscuits, remained apparently normal in all regards for weeks: no diarrhoea nor signs of unusual putrefactive decompositions in the intestine occurred; nor did ill results follow adding a moderate amount of flesh or of fat to the diet. Much flesh or fat, however, caused digestive disturbances after a few days. When soap was given, these were very marked and severe. The intestine deprived of bile can very well serve to do all necessary for the maintenance of the bodily functions; but it is so far in an abnormal state as to have its power of resisting injury, or indiscretion in diet, greatly diminished.

As regards the absorption of fats, he finds, as others, that this is much diminished when the bile is drained off through a fistula. Very little of the unabsorbed fat, however, leaves the body as such; the greater part of it being broken up, so that the excreta contain much free fatty acids. Possibly the unusual accumulation of these in the intestine is the immediate cause of its special liability to lesion. — (*Pflüger's archiv*, xxix. 1882.) H. N. M. [156

Birds.

Contributions to the anatomy of birds. — The osteological papers of Dr. Shufeldt, originally printed in the twelfth annual report of the U. S. geological survey, have also been separately published. The papers on the burrowing owl, the horned lark, the Tetraonidae, and the shrike, need but little comment, since they have been published some time. We notice, however, the addition of woodcuts of the live birds, and certain changes in the text.

The last paper, that on the Cathartidae, is of much later date. The descriptions are based on a good supply of skeletons in the Smithsonian museum and in the Army medical museum. They are illustrated by several plates and woodcuts. Special points of interest are the extensive air-canals, the solidity of the atlas, the variations of the sternum in the same species, the presence of a claw on the ungual phalanx of the first digit. The author finally concludes that the present division into genera is justified from an osteological point of view. He also agrees that there is no close relationship between the old and new

world vultures, the former being a group of the Galconidae. — J. A. J. [157

Lymph-hearts in the embryo chick. — From the observations of Panizza, Meyer, and Stannius (*Müller's arch.*, 1843, 452), it is known that lymph-hearts occur in various birds, but they have not hitherto been observed in gallinaceous forms. In structure they vary from a rudimentary to a functionally perfect condition. These facts lead Dr. Albrecht Budge to consider it probable that they are always developed, and when absent in the adult, have been atrophied. Upon investigation he succeeded in finding them in the embryo chick. He was successful in injecting the lymphatics in embryos from ten days old upwards. There are two hearts on the back, between the coccyx and pelvis. They enlarge until the time of hatching, after which they both disappear, although one is frequently lost sooner. Small vessels connect them with the *vena hypogastrica* on the one hand, and with the lymphatics, especially of the allantois, on the other. The heart is lined with an endothelium, and its wall is composed of connective tissue and spindle-shaped muscle cells. The organ pulsates independently of the blood-pulse, under favorable circumstances, sixteen times a minute: the pulsations could be first seen on the eighth day. The dissecting out of these hearts is difficult, as soon after the twelfth day they become covered by fat. — (*Arch. anat. physiol., anat. abth.*, 1882, 350.) C. S. M. [158

Mammals.

Fossil peccary from New York. — Dr. Jos. Leidy described two skulls and several portions of the skeleton of a fossil peccary from New York. The remains belong to Platygonus compressus, and were in a state of such remarkable preservation as to appear recent. — (*Acad. nat. sc. Philad.; meeting* Jan. 23.) [159

The phylogeny of the Sirenia. — Prof. E. D. Cope described a portion of the jaw of a large sirenian mammal, containing an incisor tooth or tusk, characteristic of the genus Halitherium. The specimen was from the vicinity of Charleston, S.C. It exhibits the peculiarity of possessing, exterior to the tusk, a second large tooth, which is probably also an incisor. This character was believed to distinguish the form generically from the other members of the order, and the name Dioplotherium was proposed for the genus thus defined. The species was named D. Manigaulti; and, from the proportions of the parts preserved, it was believed to have been rather larger than a dugong.

The genus furnishes a first step in tracing backwards the phylogeny of the Sirenia. These animals doubtless present the same phenomenon as that witnessed in the lines of the rhinoceroses, ruminants, and some others; viz., — a gradual reduction in number, and final extinction, of the superior incisor teeth. In Rhytina the extinction is complete; in Halicore, one remains. Dioplotherium, with two, forms the passage to the primitive types, not yet known, which possessed three. They are considerably specialized in the present genus, and a reduction of size is to be looked for in the first genera of the Sirenia. — (*Acad. nat. sc. Philad.; meeting* Feb. 5.) [160

Synovial membranes. — A monograph of their development and structure, by Oscar Hagen-Torn, has just appeared. A fissure arises by the degeneration of cells between the cartilages. The surrounding connective tissue with many but not essential changes from the embryonic cellular condition of the neighboring mesoderm becomes the synovial membrane. The enlargement of the fissure is attributed to movements of the joints. In extra-uterine life the synovialis disappears at the points of great pressure, is thinned out where there is a medium pressure, and acquires the papillose character on the other parts, which are especially exposed to the influence of the negative pressure which arises during the articular movements. — (*Arch. mikr. anat.*, xxi. 591.) C. S. M. [161

Embryology of the milk-glands. — G. Rein summarizes the results of his extended researches on the development of the milk-glands. The same type of formation was found in all the species investigated. Gegenbaur has maintained, that the majority of mammals have their teats formed by an upgrowth of the area in which the lactic glands are developed; but that in ruminants there is another type, the glandular area forming a depression, the walls of which grow up around it into a teat. Rein, however, demonstrates that the ruminants conform to the usual development. His investigations may be summarized as follows: The first trace of the milk-gland appears very early, usually when the visceral clefts are closed; in man, during the second month. The gland first appears as an ingrowth of the epidermis. The connective tissue of the nipple is next formed; the teat may be developed early (ruminants, horse, etc.), or at the end of fœtal life (man). Next secondary outgrowths arise from the primitive epidermal bud, as many as there are ducts in the adults. At this period the differentiation of the stroma from the mesoderm begins. Most of the primitive ingrowth disappears, a little remaining as the common orificial duct. The secondary epithelial growths, on the other hand, grow farther, become tubular, branch, and finally form the ducts (sinus and ducts proper) and the acini. In the human fœtus all the parts of glands are developed by the time of birth. The development is according to this same plan in all the animals investigated, comprising species of Primates, Insectivora, Carnivora, Ungulata, Glires, and Didelphyda. The so-called Montgomery glands are rudimentary milk-glands. The view advanced by Creighton and Talma, that the acini are developed from the mesoderm, is incorrect. The milk-glands cannot be regarded as modified sebaceous glands, but are organs *sui generis*. — (*Arch. mikr. anat.*, xxi. 678.) C. S. M. [162

Distribution of the genus Macroscelides. — According to M. J. Huet, this genus, as now known, ranges over all Africa, except the western portion between the tropics of Cancer and Capricorn. — (*Mission G. Révoil aux pays Çomalis.*) F. W. T. [163

Anatomical and external characters of Zalophus gillespii. — W. A. Forbes publishes two chromolithographs of the exterior of the Californian sea-lion, and the following notes together with others: No true scrotum; four inguinal mammae; no under fur; tongue bifid at the apex; stomach less globular and more elongated than in Otaria jubata; intestines much longer, and liver less differentiated, than in the latter species; an innominate gives off right and left carotids close together; trachea very wide; spleen flattened and elongated; kidneys compound. The color of the fur is described at length, and measurements are given. The full-length figures in the first plate strike one as being unnaturally stiff. — (*Trans. zoöl. soc. Lond.*, xi. 1882.) F. W. T. [164

Mammals of Essex Co., England. — Notes by H. Laver upon forty species, including seven cetaceans and the seals Phoca vitulina and Cystophora cristata. — (*Trans. Epping Forest nat. club*, ii. 1882, 157.) F. W. T. [165

Man.

Age of the mother, and sex of the child. — According to Schramm and Bidder, it appears that we may consider twenty to be the age of the most perfect female maturity; that it is at that age that women bear the largest proportion of girls; that, the farther they pass beyond that age, the more the proportion of the male to the female children increases. Rumpe deals with this question, especially as regards primiparae. He divides his cases into those where the mother was under thirty (young), and those over (old). For the old primiparae, Rumpe had 63 boys against 52 girls, or 121 : 100.

Other authors have found as follows, for *old* primiparae: —

	Boys.	Girls.
Schramm	132	100
Ahlfeld	137	100
Hecker	133	100
Krüger and Winckel	133	100

The mean proportion of all births, independent of the mother's condition, is 106 boys to 100 girls. If this increase in the relative number of boys depends on the age of the mother, then it must be the case also with multiparae. Rumpe cites 400 cases to show that it is so: 200 multiparae under thirty gave birth to 96 boys and 104 girls; i.e., 92 : 100; 200 multiparae over thirty gave birth to 110 boys and 90 girls; i.e., 122 : 100. The conclusion is therefore confirmed, that, the older the mothers, the larger the proportion of boys born. — (*Arch. f. gynoek.*, xx., 1882, 129.) C. S. M. [166

Asymmetry of the turbinated bones in man. — According to Dr. H. Allen, this may exist independently of or involving the nasal septum, and is probably due to pre-natal influences. — (*Proc. acad. nat. sc. Philad.*, 1882, 239.) F. W. T. [167

PEDAGOGY.

The use of slates. — Prof. H. Cohn of Breslau believes that the use of slates by school-children tends to produce short-sightedness; and would substitute either pen and ink, or an artificial white slate with black pencil manufactured in Pilsen, and already introduced into a few German schools. In 1878 Horner found (*Vierteljahrschrift öffentl. gesundheitspflege*, x. 4), that B and E could be read, if black on white ground, 496 cm.; if white on black, 421 cm.; and if gray on black, 330 cm.; and ascribed the greater difficulty with white letters to irradiation. The reflection of light from the surface of slates is, it is said, enough alone to cause their disuse. The school-board of Zürich has forbidden the use of the slate after the first term (primary year), and many teachers and oculists advocate the substitution of white-boards for black-boards. The noise of slates; dirty habits formed by erasures; bad positions favored by reading the less legible script; a heavy hand; and the habit of twisting learned with a pencil, and to be unlearned with a pen, — these, it is said, are obviated by the use of pen and ink at the outset. The obvious objections are, that children can occupy themselves better with slates, and from pencil to pen is from the easier to the harder. — G. S. H. [168

Curriculum in Prussian gymnasia. — The most important changes in the recent revision of the study-plans of the Prussian gymnasia, which had remained essentially unaltered between 1856 and 1882, are as follows: 1. One hour per week less of Latin during the first five, and two less during the secunda years. Greek begins one year later, but for four years gains an hour per week. Writing and religion receive also less time. 2. What is thus gained is divided nearly equally between French, history and geography, mathematics, physics and natural science, and drawing. Save in the reduction of Latin, the change is slight, but significant, and much discussed, as a departure towards the plan of the real-school. — G. S. H. [169

School savings-banks. — The advisability of school savings-banks elicits much discussion in Germany. On the one hand, it is claimed that pupils may be taught self-denial, foresight, interest in great mercantile and other operations remote from their own narrow lives; encouraged in bookkeeping; saved from the noxious effects of bad confectionery; if poor, encouraged in helping their parents; and ideality and healthful moral sentiments cultivated by directing their plans for future use of their money to beneficent objects. On the other hand, the opponents of school-banks urge, that they encourage a commercial view of life prematurely; that, as school-children seldom earn money, they will be stimulated to tease or steal it from their parents or others, when, to be properly possessed, money should be earned; and that this is not the most pedagogic method of instruction. The plan has perhaps been most fully tried in Ghent, where, out of 15,392 scholars in the lower schools, 13,032 have accounts in the school savings-banks of the place; the average for each depositor being about 35 francs (seven dollars). — G. S. H. [170

Herbart's works. — The first volume of a new edition of Herbart's works, just published by Veit & Co., contains his pedagogical writings. As Herbart was the first to attempt to give a scientific character to pedagogy, and a more or less philosophical one to Pestalozzi's incoherent insights, his historic significance is great; although advance has been made beyond his position by his followers in pedagogy (Beneke, Diesterweg), as well as by his philosophical disciples. A number of critiques and other interesting *inedita*, the existence of which seems to have been unknown to the compilers of the former Hartenstein edition, add considerably to the value of the new edition. — G. S. H. [171

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

The fisheries exhibition. — Mr. T. W. Smillie, photographer of the museum, is preparing a series of photographs to accompany the fisheries exhibit, which will be sent to London in the spring. The views, many of which are those of fishing-vessels and boats in motion, were taken by an instantaneous process. The positives, which measure 30 × 40 inches, and are, perhaps, the largest photographs ever taken for display without crayoning, are obtained by aid of the electric light. The rays from a Brush lamp are passed through an achromatic condenser 13½ inches in diameter, thence through a negative and through a large portrait-lens; they are then thrown upon a screen placed at a distance of 7 or 8 feet from the camera. A sensitized sheet of paper, of dimensions a little

exceeding those given above, is hung on the screen, and exposed for 15 or 20 minutes. The picture is developed by pyrogallic acid, and fixed by hyposulphite of soda.

Lighting the museum. — Experiments are being made with a view to lighting the museum building by electricity.

The ceramic collection. — A magnificent Sèvres vase 3¼ feet in height was recently given by Mr. Lazarus Strauss of New York. It is one of the finest products of the Sèvres pottery, and was valued in France at 6,000 francs.

Thin sections of anthracite coal. — Mr. G. P. Merrill, of the department of rocks, who spent some time in the attempt to prepare transparent sections of anthracite coal for the microscope, has abandoned the enterprise as being outside the limits of possibility. So far as his experience goes, the sections offered by dealers are of imperfectly carbonized wood-nodules and other similar substances.

Naval observatory.

Ephemeris of the great comet, b. 1882. — Computed from elements (Nature, 688), and reduced to the mean equinox, 1883.0.

GREENWICH MEAN NOON.

		R. A.	Declination.	Log. r.	Log. Δ.
1883.		h. m. s.	° ′ ″		
Feb.	10.0	6 0 37.8	19 41 17	0.48137	0.38891
	14.0	5 57 40.4	18 40 13	0.48909	0.40520
	18.0	5 55 19.7	17 41 17	0.49669	0.42132
	22.0	5 53 32.7	16 44 35	0.50413	0.43723
	26.0	5 52 14.7	15 50 14	0.51133	0.45282
March	2.0	5 51 24.4	14 58 16	0.51841	0.46817
	6.0	5 50 58.7	14 8 43	0.52532	0.48322
	10.0	5 50 54.8	13 21 37	0.53200	0.49790
	14.0	5 51 12.3	12 37 0	0.53861	0.51231
	18.0	5 51 47.9	11 54 52	0.54508	0.52635
	22.0	5 52 39.5	11 15 10	0.55135	0.53995
	26.0	5 53 46.1	10 37 56	0.55751	0.55316
	30.0	5 55 6.1	10 3 6	0.56354	0.56594
April	3.0	5 56 38.1	9 30 34	0.56944	0.57828
	7.0	5 58 20.9	9 0 19	0.57520	0.59015
	11.0	6 0 13.9	8 32 21	0.58090	0.60158

E. FRISBY, *Prof. Math., U.S.N.*

Washington, Feb. 10, 1883.

Note. — In the published elements, ϕ should be 89° 13′ 42″.70, instead of 89° 7′ 42″.70.

(Communicated by Vice-Admiral Rowan, Supt. U. S. naval observatory.)

Department of agriculture.

Anthrax or charbon. — In December last Mr. Charles J. Whitmore of Boston addressed a letter to the commissioner, stating that the Vicomte de Coettogan had obtained the concession of the use of the Pasteur method of vaccination for America, and desired to ascertain: 1°, whether charbon-fever exists in the United States; 2°, whether Pasteur's method could be introduced here with vaccine from Pasteur's laboratory; and, 3°, whether such introduction would prove profitable to the introducer.

The commissioner referred the letter to Dr. D. E. Salmon of the veterinary corps of the department, who reports as follows: —

1. In the northern and western states, charbon-fever occasionally occurs on isolated farms among cattle; but it is not known that sheep are very often affected. The same is true of many of the southern states; but in the gulf states, and especially in the lower Mississippi valley, charbon at times becomes extremely destructive to all kinds of domestic animals, especially after great inundations. Heavy losses in stock experienced in certain years in Tennessee, Arkansas, Missouri, etc., may or may not have been caused by charbon; no competent investigation having been made.

2. This question is not so easily answered, as it involves, first, the bringing the vaccine from France, and keeping it here until needed; secondly, the determination of the strength which should be originally given it to make it safe for *our* animals; thirdly, public experiments to convince our farmers of the usefulness of the vaccination.

Pasteur's method requires the use of two vaccines of different strengths, which cannot be kept stable for any length of time; the weaker vaccine becoming ineffective, while the stronger virus frequently produces fatal results. This has been proven by experiments in different parts of France, in Germany, and England, made partly by Pasteur's assistants. Moreover, Pasteur himself admits that the animals of different countries are of various degrees of susceptibility, and that he had to vary the strength of his vaccine to suit the constitution of the animals. To determine the comparative susceptibility of American animals, would alone be a work of considerable magnitude and expense, requiring at different points a number of such public experiments as were made in France.

3. The introduction of the method by private persons with any idea of profit would therefore probably be doomed to failure; but as the preparation of the charbon vaccine is no secret, the establishment by the general government of a laboratory for the preparation and free distribution of the vaccines for charbon and other contagious diseases of animals would seem to be desirable.

PUBLIC AND PRIVATE INSTITUTIONS.

Boston society of natural history.

Teachers' school of science. — This department of the society has become well known to Boston people by its efforts for the education of teachers since its inception in 1871. During some winters several courses of lessons have been given to large audiences, which were accompanied by other laboratory series with smaller audiences, on subjects ranging throughout the physical and natural-history branches of knowledge.

The present winter's work consists of only two courses: one of ten lessons on physical geography, by Prof. W. H. Niles; and one of five on physiology, by Dr. H. P. Bowditch.

Prof. Niles's course has been eminently practical, and is much praised by the teachers in attendance; who say that he gives them trustworthy and original views, and modes of treating the subject, which they can use in their school-work. Dr. Bowditch will probably carry out the same plan as last year, in which he was equally successful in showing teachers how to use the bodies of their own pupils in such simple physiological experimentation as is needed in the public schools.

The larger public courses have been for two years under the patronage of the Lowell fund, of which Mr. Augustus Lowell is trustee; and his liberality in allowing the use of Huntington Hall on Saturdays has enabled the curator of the Society, Prof. Alpheus yatt, to re-organize the management, and extend

the benefits of the lessons to all towns near Boston. The school now has agents interested in the proper distribution and use of its tickets, not only in Boston, but also in the larger number of the suburban towns which cluster around that municipality.

The following statistics of this winter's courses will speak for themselves with regard to the probable benefits of this extension of its efforts over a wider field: —

Subjects.	Applications received.	Tickets sent.
Physical geography	988	1,098
Physiology	834	945
	1,822	2,043

Distribution of Tickets.	Phys. geog.	Physiol.
Boston	364	302
Neighboring towns (45)	589	512
Complimentary, school authorities and private persons	145	131
	1,098	945

Grade of teachers: Superintendents, 10; sub-masters, 24; principals, 157; assistants, 847. The average attendance so far upon the first course has been from six to seven hundred.

The school has also had another branch in active operation, in which the courses are paid for by the teachers themselves. The curator, assisted by Mr. Van Vleck, has had two classes in zoölogy occupying four winters, and numbering in all fifty-nine teachers; Mr. B. H. Van Vleck, a class in physiology numbering fifteen teachers; and Mr. W. O. Crosby, a special class in geology. These classes have demonstrated a demand for the kind of knowledge offered, so earnest that a good proportion of the teachers have been willing to surrender their holidays to laboratory work, and also to pay for the privilege. A number more would have attended but for the obstacle of the fee necessarily charged for tuition. These classes, now that the reality of this demand has been shown, should be placed on a more liberal basis, and one more consistent with the usual policy of the society with regard to the needs of our public schools. Owing to a combination of causes which it would be useless to detail, these laboratory courses formerly given every Saturday throughout the winter have been discontinued during this season. It is intended to resume them as soon as practicable.

Academy of natural sciences, Philadelphia, Penn.

Instruction in mineralogy and lithology. — At the close of Prof. Heilprin's lectures, Prof. H. Carvill Lewis will deliver a course of instruction in mineralogy and lithology, a large portion of which will consist of a series of field-lectures upon the mineralogy and lithology of Philadelphia and vicinity. In addition to lectures at the academy, and alternating with them, there will be about ten short excursions to interesting localities in the neighborhood of the city, where the strata and their enclosed minerals will be studied in place, and practical methods given for recognizing both rocks and minerals and their relation to the geology of the region. The specimens collected in the field will be more carefully examined and studied with laboratory practice at the academy at the lecture following each excursion.

The introductory lecture will be delivered on Tuesday, April 17, 1883, in the lecture-room of the academy, at 4.15 P.M.; and the lectures will continue at the same hour on successive Tuesdays and Fridays. The field-lectures, commencing early in May and continuing until July, will take place on Fridays (weather permitting), and will occupy the greater part of the day.

Among the localities visited will be the quarries of hornblendic gneiss at Germantown and Frankford, the soapstone quarries on the Schuylkill, the limestone and marble quarries, and the iron-mines of the Montgomery County Valley, the lead, zinc, and copper mines near Phœnixville, the mineral localities of Delaware County, etc.

NOTES AND NEWS.

— The description of the fossil remains of the remarkable flying reptile, Rhamphorhynchus phyllurus Marsh, which was given in the American journal of science in April, 1882, has been supplemented by the liberal distribution of casts of the original by Prof. O. C. Marsh. These are faithful representations in all the more important characteristics prominent enough to make their re-appearance upon a plaster casting. The wings and caudal paddle are the most important features, and render this fossil unique of its kind. The wings are particularly well rendered, and perfectly distinct in outline and details. The steering-paddle at the end of the long, attenuated tail, and the tail itself, is distinct in outline, but deficient in details; the bones of the hands are also in the same state, all these parts being very small.

Professor Marsh, in distributing these and other casts of his rare and remarkable fossils, has added very greatly to the usefulness of his own work and the diffusion of knowledge, besides setting a shining example of scientific liberality. He has, we know, in several instances, and we presume in all cases, demanded no exchange of any kind. Many institutions now have the means of placing before visitors and students the actual condition of the fossil remains of one of the most remarkable of the extinct Jurassic reptiles. This is so nearly perfect that it shows there is no exaggeration in the restoration accompanying Professor Marsh's descriptions, which represents this pterodactyle flying through the air with its wings expanded.

— The following persons were elected officers of the biological society of Washington, on Jan. 5: President, Prof. C. A. White; Vice-Presidents, Prof. C. V. Riley, Prof. Lester G. Ward, Mr. William H. Dall, Prof. Theodore Gill; Secretaries, Mr. G. Brown Goode, Mr. Richard Rathbun; Treasurer, Dr. Tarleton H. Bean; Members of Council, Dr. George Vasey, Dr. D. Webster Prentiss, Prof. Otis T. Mason, Mr. Frederick W. True, Dr. Elliott Coues.

— At the meeting of the Albany institute held Jan. 16, officers of the institute at large and of its three departments were chosen for the ensuing year. The following, by virtue of their offices, constitute the executive committee provided for by a recently adopted by-law: President, Orlando Meads, LL.D.; Treasurer, John Templeton; Recording secretary and libra-

rian, Daniel J. Pratt, Ph.D.; Corresponding secretary, Leonard Kip; President of first department and one of the vice-presidents of the institute, David Murray, LL.D.; President of second department and one of the vice-presidents, J. A. Lintner; President of third department and one of the vice-presidents, Henry A. Homes, LL.D.

— Some oysters have recently been received by Lieut. Winslow of Washington, from Barnegat, N.J., which seem ready to spawn, — an unusual condition of matters, since the spawning season at that latitude is supposed to be at an end in August.

— The bronze statue of Professor Joseph Henry, by W. W. Story, has arrived in America. The ceremony of unveiling will take place upon the grounds of the Smithsonian institution in April, during the session of the National academy of sciences.

— The annual meeting of the regents of the Smithsonian institution was held in Washington on Jan. 17. All the regents were in attendance except Dr. Noah Porter and Mr. Peter Parker. Professor Baird reported upon the state of the finances as follows: receipts for 1882, $67,435.52; expenditures, $37,798.-07; balance available to July 1, 1882, $29,637.45. At the suggestion of Dr. Maclean, Professor Baird was appointed to collect and publish the scientific writings of Dr. Henry.

— Dr. Orville Derby, curator of geology in the national museum of Brazil, has recently arrived in Washington. He will complete the arrangements for the publication of the results of the geological survey of Brazil, organized under the late Prof. C. Fred. Hartt. Dr, C. A. White is preparing the report on the cretaceous mollusks and echinoderms. He has already completed the sections of conchifers, gasteropods, and cephalopods. Twenty-four quarto plates are drawn and finished. Ninety per cent of the species are new. Three new genera of gasteropods have been described. The whole work upon invertebrates will comprise as much matter as has been hitherto published on the same subject for all South America, and will undoubtedly form an epoch in the development of the invertebrate paleontology of that continent.

— At the meeting of the Boston society of natural history on Feb. 7, Dr. M. E. Wadsworth gave some instances of atmospheric action on sandstone. Mr. Lucien Carr discussed the social and political position of woman among the Huron-Iroquois tribes, and Mr. John A. Jeffries spoke of the dermal appendages of birds.

— At the meeting of the Appalachian mountain club Feb. 14, Mr. W. H. Pickering exhibited, with the lantern, photographic views taken during the club's recent excursion to the White Mountains; and Mr. J. Tatlock, jun., read a paper on the principal coefficients in the barometric formula of Laplace, as applied to the White-Mountain region.

— At the thirty-second annual meeting of the Michigan state teachers' association, held at Lansing, Dec. 27–29, papers were read by J. S. Crombie on The need of visible illustration, and the proper use of apparatus; by H. R. Pattengill, on Science in primary schools; and by Prof. V. M. Spalding, on The microscope in our public schools. An exhibition of microscopic objects and apparatus took place at the evening session the first day.

— At a meeting of the American philosophical society, held at Philadelphia on Feb. 1, Prof. J. T. Rothrock read a paper on Some microscopic distinctions between good and bad timber of the same species.

— The American institute of mining engineers will hold its annual meeting in Boston next week. The opening session will be at the Brunswick hotel on Tuesday evening, when addresses of welcome will be given by Mr. Edward Atkinson, and, on behalf of the Boston society of civil engineers, by Mr. Thomas Doane. Papers will be read at this session as well as at the sessions held on Wednesday and Friday at the Massachusetts institute of technology, and on Thursday afternoon at Sever hall in Cambridge. Excursions will be made on Wednesday, to the Leavitt pumping-engine, the Carson sewer-excavating apparatus, and the Norway iron-works; on Thursday, to the Watertown arsenal to inspect the U. S. testing-machine, and to Harvard university; after the session, to Lowell and to Worcester to visit the manufactories and institutions of those cities. The subscription dinner is to be at the Brunswick, at eight o'clock on Thursday.

The following papers have been announced: Gas-producer explosions; by P. Barnes, Elgin, Ill. — Microscopic analysis of the structure of iron and steel; by J. C. Bayles, N. Y. — Metallurgy of nickel in the U.S.; by W. P. Blake, New Haven. — The mining regions about Prescott, Arizona; by John F. Blandy, Prescott. — The collection of flue-dust at Ems; by T. Egleston, N.Y. — The eozoic and lower paleozoic in South Wales, and their comparison with their Appalachian analogues; by Dr. Persifor Frazer, Philadelphia. — Note on the geology of Egypt, with especial reference to the rocks from which the obelisks have been taken; by Dr. Persifor Frazer. — Notes on a protected iron hot-blast stove; by Frank Firmstone, Easton, Penn. — The shop treatment of structural steels; by A. F. Hill, N. Y. — A suggestive cure for blast-furnace chills; by H. M. Howe, Boston. — Coal and iron of Alabama; by T. Sterry Hunt, Montreal. — Lines of weakness in cylinders; by R. H. Richards, Boston. — The strength of American woods; by S. P. Sharples, Boston. — Determination of manganese in spiegel; by G. C. Stone, Newark, N. J. — History and statistics of the manufacture of coke; by J. D. Weeks, Pittsburg, Penn. — Notes on settling-tanks in silver-mills; by Albert Williams, jun., Washington.

— That most enterprising of our scientific societies at the west, the Davenport academy of natural sciences, is about to complete the third volume of its 'proceedings' by the publication of the memoir on Solpugidae nearly completed by its late president, J. D. Putnam, a young naturalist of rare promise and industry. The publishing committee, with commendable enterprise, are endeavoring to procure sufficient subscribers to the number to pay the cost of publication, and have already secured 140 of the 180 required. Mr. Putnam's paper is edited by Prof. H. Osborn, of Ames, Iowa; and its four plates engraved under the superintendence of Dr. H. A. Hagen of Cambridge. A portrait of Mr. Putnam will accompany the paper.

— At the meeting of the Biological society of Washington, Feb. 2, an adjourned discussion of the presidential address took place; Dr. Elliott Coues read a paper on Zoölogical nomenclature applied to histology; and Prof. O. T. Mason, on the Human fauna of the district of Columbia.

— The January number of the Harvard university bulletin, recently issued, commences a new volume. We miss the 'notes' which formed such an admirable feature of the last volume, but are glad to know that they will again be resumed. Two pages and a half are given up to the accessions to the University library in science, in which we note a collation of the copies of the several volumes of Wilkes's exploring expedition in the libraries of Cambridge and vicinity. Of interest to scientific men are Mr. Bliss's classified index to the maps in Petermann's mittheilungen (six pages more of which are given), and Mr. Winsor's commencement of a bibliography of Ptolemy's geography.

— No. 4 of the Library of Cornell University for January contains fourteen additional pages of the valuable classed list of the rich collection of works relating to mathematics in that institution, making forty-five pages so far published. Both main and subordinate topics are arranged alphabetically; and the present instalment completes astronomy, and gives, in addition, calculus, engineering, functions, etc., and enters geometry.

RECENT BOOKS AND PAMPHLETS.

Acadian scientist (The): published in the interests of the Acadian science club. vol. i., no. 1. Wolfville, N. S. 1883. 8 p., *m.* 4°.

Baltet, C. De l'action du froid sur les végétaux pendant l'hiver 1879–80. Paris, *Masson.* 1882. 340 p. 8°.

Boston. — Archæological institute of America. Bulletin, i. Bost., *Williams.* 1883. 40 p. 8°.

Cohn, F. Die pflanze. Vorträge aus dem gebiete der botanik. Breslau. 1882. 8°.

Crowther, J. The unwritten record; a story of the world we live on. With an introductory note by J. R. Macduff. Lond., *Sunday School Union.* 1883. 178 p. 8°.

Delattre, C. Étude sur les gisements français de phosphate de chaux; note sur la décomposition du phosphate bicalcigne par l'eau. Paris, *imp. Davy.* 1882. 80 p. 8°.

Delaurier, E. Essai d'une théorie générale supérieure de philosophie naturelle et de thermochimie, avec une nouvelle nomenclature binaire notative pour la chimie minérale et organique. Fasc. i. Paris, *imp. Lahure.* 1882. 82 p. 8°.

Dunman, T. Talks about science; with a biographical sketch by C. Welsh. *New ed.* Lond., *Griffith.* 1883. 250 p. 8°.

Dreyfus-Brisac, E. De la liberté d'enseignement. Paris, *Masson.* 1882. 46 p. 8°.

Geikie, A. Geological sketches at home and abroad. Lond., *Macmillan.* 1882. 8°.

Harting, J. E. Essays on sport and natural history. Lond., *Cox.* 1883. 490 p. illustr. 8°.

Madison. Washburn observatory. Publications. Vol. i. Madison. 1882. 8°.

Middletown. — Museum of Wesleyan university. Eleventh annual report of the curator. Middlet., *Pelton and King, pr.* 1882. 13 p. 8°.

Moleschott, J. K. R. Darwin. Denkrede gehalten im collegio romano zu Rom. Giessen. 1883. 47 p. 16°.

Miller, S. A. The American palaeozoic fossils: a catalogue of the genera and species, with names of authors, dates, places of publication, groups of rocks in which found, and the etymology and signification of the words, and an introduction devoted to the stratigraphical geology of the palaeozoic rocks. Cincinnati, *Author.* 1877. 16 + 246 p. 1883. P. 247–334. 8°. P. 247–334 form a supplement.

Morel, C., et **Duval**, M. Manuel de l'anatomiste. Paris, *Asselin.* 1883. 14 + 1152 p. illustr. 8°.

Nadaillac, *marquis* de. L'Atlantide et les oscillations de l'ecorce terrestre. Paris, *Gervais.* 1882. 24 p. 8°.

Noack, Ernst. Ueber die phenylester der phosphorigen säure. Inaug. diss. Tübingen, *Fues.* 1882. 42 p. 8°.

Oppolzer, T. von. Lehrbuch zur bahnbestimmung der kometen und planeten. 2. *aufl.* i bd. Leipzig, *Engelmann.* 1882. 12 + 683 p. 8°.

Pasch, M. Vorlesungen über neuere geometrie. Leipzig. 1882. 8°.

Quenstedt, F. A. Die schöpfung der erde und ihre bewohner. Stuttgart. 1882. 59 p. 8°.

Questions controversées de l'histoire et de la science. 3e série. Paris, *Tardieu.* 1882. 333 p. 8°.

Rehm, H. Ascomycetes lojkani lecti in Hungaria Transsylvania et Galicia. Budapest. 1882. 4 + 70 p. 8°.

Reinsch, P. F. Mikrophotographien über die strukturverhältnisse und zusammensetzung der steinkohle der carbon, entnommen von mikroscopischen durchschnitten der steinkohlen. Leipzig, *Weigel.* 13 p., 13 pl. 4°.

Richthofen, F., *freiherr* von. China. Ergebnisse eigener reisen und darauf gegründeter studien. iver bd. Palaeontologischer theil. Berlin. 1883. illustr. 4°.

Rusz, Karl. Die sprechenden papageien. Berlin, *Gerschel.* 1882. 16 + 404 p. 8°.

Simony, Friedrich. Gletscherphänomene. Wien, *Hölzel.* 1883. 24 p., pl. 8°.

Stitzenberger, E. Lichenes helvetici eorumque stationes et distributio. Fasc. i. St. Gallen, *Köppel.* 268 p. 8°.

Strasser, H. Zur lehre von der ortsbewegung der fische durch biegungen des liebes und der unpaaren flossen, mit berücksichtigung verwandter locomotionsformen. Stuttgart. 1882. 8°.

Sydney, N. S. W. — Observatory. Results of double star measures made at the observatory, 1871 to 1881, under the direction of H. C. Russell. Sydney. 1882. 68 p. 8°.

Thomas, Cyrus. A study of the manuscript Twano; with an introduction by D. G. Brinton. (U.S. geogr. geol. surv. Rocky Mt. region. — Contrib. Amer. ethnology v.) Wash., *Government.* 1882. 37 + 237 p., 9 pl. 4°.

Thomsen, Jul. Thermochemische untersuchungen. ii. bd., metalloide. Leipzig, *Barth.* 1882. 14 + 506 p., pl. 8°.

U.S. — Light house board. Annual report for the year ending June 30, 1882. Wash., *Government.* 1882. 8°.

Vaile, O. E. Pro and con of spelling reform. Ed. by Eliza B. Burnz. N.Y., *Burns.* 1882. 16 p. 12°.

Vogt, C. et **Yung**, E. Traité d'anatomie compareé pratique. Livr. i. Paris, *Reinwald.* 1883. 80 p. 8°. To be completed in 12 parts.

Vogt, K., and **Specht**, F. Die säugetiere in wort und bild. Lief. i. München. 1882. illustr. f°.

Wake, C. S. The origin and significance of the great pyramid. Lond., *Reeves.* 1883. 98 p. 8°.

Wright, L. Light: a course of experimental optics, chiefly with the lantern. London. 1882. illustr. 8°.

Wood, T. Practical lessons on insect life. Lond., *Hughes.* 1883. 172 p. 12°.

IMPORTANT NEW BOOKS.

JAMES MONROE.

By D. C. GILMAN, President of Johns Hopkins University. Vol. VI. of "American Statesmen" series. 16mo, gilt top, $1.25.

The biography of President Monroe has never before been written; and in this book Mr. Gilman produces no small amount of fresh material for elucidating the history of our government at a time when several important questions, notably the Monroe doctrine, were engaging public attention. The book contains so much that is new, and is so well written, that it will be found one of the most valuable volumes in the series of "American Statesmen."

RIVERSIDE HAWTHORNE.

Vol. I. Twice-Told Tales.
Vol. II. Mosses from an Old Manse.
Vol. III. The House of the Seven Gables, and the Snow Image.
Vol. IV. A Wonder-Book, Tanglewood Tales, and Grandfather's Chair.

Each containing an introductory note by Mr. GEORGE P. LATHROP, author of "A Study of Hawthorne," an original full-page etching, and a vignette wood-cut. Crown 8vo, gilt top, $2 a volume.

The new *Riverside edition* of Hawthorne's works has won immediate popularity by the unsurpassed excellence of the contents and of the beautiful style in which it is produced. It will be complete in twelve volumes.

**** For sale by all booksellers. Sent by mail, postpaid, on receipt of price, by the Publishers,*

HOUGHTON, MIFFLIN, & CO.,

BOSTON.

CASHMAN, KEATING, & CO., PRINTERS,
Fayette Court, 603 Washington Street, Boston.
JOHN CASHMAN. JAMES KEATING.

J. W. STANIFORD, manufacturer of HOMŒOPATHIC AND SPECIMEN PHIALS, and dealer in Chemical Glass-Ware, Glass Tubing, etc., No. 23 Elm Street, Boston, Mass.

MERRIMAC CHEMICAL CO. Organized in 1863. Manufacturers of Oil Vitriol, Muriatic Acid, Nitric Acid pure, Sulphate of Soda, Muriate of Tin, Tin Crystals, Soda Ash, Glauber's Salt, Refined Sulphur, Blue Vitriol, etc.; also dealers in Aqua Ammonia, Acetic Acid, etc.
C. T. HOWARD, Treas. A. P. HOWARD, Supt.
Office at 73 Kilby Street, Boston.
Works at South Wilmington, Mass., on the Boston and Lowell Railroad.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

HOW TO USE KNITTING SILK. A handsome illustrated book, with rules and diagrams which are wholly trustworthy. Sent postpaid for 5 cents in stamps. Address GEORGE D. ATKINS, 18 Summer Street, Boston.

OFFICE OF THE FORBES COMPANY,

BOSTON.

TO SCIENTIFIC MEN:—

Your attention is called to our establishment as the most thoroughly equipped in the world, for all kinds of printing, drawing, and illustrating ever required by scientific men.

All modern processes of illustration are done by us on our own premises, and include, besides others,—

LITHOGRAPHY AND CHROMO-LITHOGRAPHY—used chiefly for commercial work, maps, and line work, where the drawing is made directly on stone, and where one or any number of colors are desired.

PHOTO-LITHOGRAPHY—the simplest and most economical process of obtaining, at low cost, a number of prints where a jet-black line drawing is furnished on white paper from which to photograph.

PHOTO-ENGRAVING—producing at half cost of wood engraving an ordinary electrotype from any line drawing.

ALBERTYPE—the most satisfactory of all the processes for obtaining photographic facsimiles of any class of originals producing the effect either of line engravings, or of a photograph.

We cheerfully furnish full information and estimates to all who may need illustrations of any kind.

THE FORBES COMPANY, BOSTON.

SPECTACLES. A. J. LLOYD, Optician, 78 Tremont Street, opposite entrance to Tremont House, Boston, Mass. "The Boston Post," Sept. 11, 1882, in an article on the importance of seeking reliable opticians, when persons are in need of spectacles, said, "One of the editors of 'The Post,' who has worn glasses made by the best-known opticians of Boston, has pleasure in recommending Mr. A. J. Lloyd as being the best he has tried."

BINDERS FOR "SCIENCE." A large assortment of the best binders for SCIENCE, and all other periodicals, to be had by mail, at the lowest prices. MELVIL DUI, Library Bureau, 32 Hawley Street, Boston.

STATIONERY of all descriptions at HENRY A. YOUNG & CO.'S, 25 Arch Street, Boston. The attention of authors is called to our large line of low-priced fine manuscript papers. Correspondence solicited.

BLANK BOOKS TO ORDER, a specialty, at HENRY A. YOUNG & CO.'S, 25 Arch Street, Boston. Estimates furnished.

BOSTON FOREIGN BOOK AND PERIODICAL ESTABLISHMENT. CARL SCHOENHOF, 146 Tremont Street, Boston. Agents in all leading European cities. Catalogues sent when applied for.

SECOND-HAND BOOKS BOUGHT IN every department of literature. Prices quoted on standard books by mail. The largest retail bookstore in New England.
W. B. CLARKE & CARRUTH,
340 Washington Street, Boston.

CUSHING'S MANUAL OF PARLIAMENTARY PRACTICE. The recognized authority in all the States on rules and order of debate, and is an indispensable handbook for every citizen. Price, 75 cents. Sent by mail on receipt of price.
THOMPSON, BROWN, & CO., Publishers,
25 Hawley Street, Boston, Mass.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.
Engraver on Wood. References: American Steam Gauge Co., Boston Journal of Commerce.

YALE COLLEGE OBSERVATORY,

NEW HAVEN, CONN.

Receives Thermometers for certificates of comparison with standards, and Time-pieces for certificates of rate.

Descriptive circulars will be mailed on application to the Secretary of the Observatory.

EVANS'S NEWSPAPER ADVERTISING Agency, Tremont Temple, Boston, makes contracts for advertising in all newspapers and periodicals at rates far less than an advertiser can get direct from publishers. Here also competent persons make a special study in the preparation of advertisements so as to get the best effect, in the least space, at the lowest cost. Advertisers who patronize the long-established agency save money, time, and labor. The Evans Agency has been established many years, and has a long list of constant patrons. Correspondence promptly attended to.
T. C. EVANS, Tremont Temple, Boston.

ANCHOR LINE. The steamers of the Anchor Line sail from New York to Glasgow, Saturday, carrying the United-States mails. From New York to Barrow-in-Furness and to Avonmouth (Bristol), at regular intervals. Drafts issued (payable free of charge) on Great Britain and Ireland, at lowest rates. For freight, passage, and all other information, apply to HENDERSON BROTHERS, 7 Bowling Green, New York, and 7 and 9 State Street, Boston.

GEORGE H. BINNEY,
Fire and Marine Insurance Broker,
35 Congress Street, Room 23, Boston, Mass.
Post Office Box 1752.

EDWARD A. FREEMAN,
Broker in Miscellaneous Stocks.
Loans negotiated. Correspondence invited.
No. 7 Exchange Place, Boston.

WANTED—All inventors to know that I make no charge for obtaining patents until after the patent is actually allowed. Over thirty years' experience. Book sent free.
C. A. SHAW, 11 Court Street, Boston.

KIDDER, PEABODY, & CO., BANKERS, No. 113 Devonshire Street, issue Mercantile and Travellers' Credits, available in all parts of the world, through Messrs. Baring Brothers & Co., London, and their correspondents. Buy and sell foreign exchanges and telegraphic transfers on Europe, California, and the British Provinces; also, stocks, bonds, and all United States securities. Stock and bond orders executed in this and other markets.
KIDDER, PEABODY, & CO., Boston.

CHARLES RIVER NATIONAL BANK of Cambridge, Mass. State charter, 1832; National, 1864. Capital, $100,000; surplus, $50,000. Samuel B. Rindge, *President;* Eben Snow, *Cashier;* Samuel B. Rindge, William T. Richardson, David B. Flint, William Kimball, and Eben Snow, *Directors.* Banking-House, at No. 1 Harvard Row, Cambridge, Mass.

$30,000 METROPOLITAN R.R. 7s.
Due April 1, 1884. For sale by
PERKINS, DUPEE, & CO., Bankers,
40 State Street, Boston, Mass.

AMERICAN LOAN AND TRUST COMPANY, 55 Congress Street, Boston. Capital, $1,000,000. Legal depository for administrators and courts of law. Authorized trustee for corporations and municipalities. Interest allowed on deposits for full time they remain. First-class investment securities bought and sold.
EZRA H. BAKER, President.
N. W. JORDAN, Actuary. E. A. COFFIN, Treas.

MAVERICK NATIONAL BANK,
Corner Water and Congress Streets, Boston. Capital, $400,000; surplus, $400,000. Accounts of banks, associations, societies, and individuals received. United States bonds and investment securities bought and sold. Sterling exchange on England, Ireland, and Scotland drawn. Telegraphic transfers of money made to all parts of the United States, Canada, and Great Britain. Letters of credit issued, payable throughout the United States.
ASA P. POTTER, President.
J. J. EDDY, Cashier. J. W. WORK, Asst Cash.

COAL AND WOOD.
W. T. RICHARDSON & CO.,
College Wharf, Cambridge, Mass.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

FRIDAY, FEBRUARY 23, 1883.

THE BALFOUR MEMORIAL.

The death of Francis Maitland Balfour last July was felt by many as a heavier blow to biological science than the loss of Darwin. The immortal master had nearly finished his work: Balfour's had but commenced. There was therefore added to the emotion of personal bereavement the perhaps less poignant but deeper grief due to the fact that science had sustained, through Balfour's early death, an almost irreparable loss. His work had already yielded such rich fruits that we hardly knew how to put a limit to what we might expect from him in the future. His genius, patience, knowledge, technical skill, and critical judgment were so apparent in his published works, that when he died aged but thirty-one years, he was already recognized throughout the civilized world as an eminent authority on morphological questions. All young English biologists looked upon him as the undisputed future leader of morphological science in their country. The feelings towards him of older men have been expressed by Professor Huxley: "It is no exaggeration to say, that to my eyes, and to those, I take it, of many of my age, Professor Balfour seemed to be like that Lycidas of whom Milton spoke: —

'Dead ere his prime,
Young Lycidas, and hath not left his peer.'"

Of the beauty of Balfour's character we cannot here speak: its remembrance will ever remain a cherished and inspiring possession of every one who knew him.

It was impossible that the death of such a man should not be followed by some effort on the part of his contemporaries and fellow-workers in science to express the esteem in which they held him and his work. We desire to call attention to the admirable form which the Balfour Memorial is to take; namely, the establishment of a permanent fund, the income of which is to be used exclusively for the promotion of biological research.

The Balfour Memorial took definite shape at a meeting held in the University of Cambridge last October, attended and addressed not only by the leading biologists of Great Britain, but by distinguished theologians, classical scholars, chemists, and mathematicians. This co-operation of leaders in so many lines of thought was a most striking testimony to the wide-spread regard felt for Balfour's personality, and to the value attached to his influence by many who were not able to appreciate the technical importance of his morphological discoveries.

At the meeting it was decided to found a Balfour Memorial, and that this should take the form of an endowment fund "for the promotion of biological research, especially in morphology:" also, that the income yielded by the 'Balfour Fund' should be employed, (1) in the payment of £200 a year to a young biologist for his support while engaged in morphological research; and (2) in occasional grants to the Balfour student, or other biologists, for the promotion of research, — as, for example, by providing the means of visiting parts of the world especially suited for the prosecution of investigations on hand, or by supplying expensive apparatus or rare specimens. It was also decided unanimously, that, though the fund should be in some way closely connected with Balfour's own university, yet others than members of the University of Cambridge should be eligible as Balfour students.

We can conceive of no more suitable form for the Balfour Memorial than that selected. As the work of him whom it commemorates was cosmopolitan, so are to be the benefits of the fund. By perpetuating Balfour's name through all future time in connection with biological research, it appeals to the sympathy of all who knew him or his work. By affording support for a year or two to young men qualified to advance knowledge, it will, through generations to come, save for science many, who, without such help while winning their spurs, would have been forced into a professional or business career. Thus not only will science be advanced, but Balfour's work passed on from hand to hand; so that the increase of knowledge which we had hoped for from him

will, in the course of time, come to us through the work of successive 'Balfour students.'

The sum already subscribed in England is more than sufficient to provide for the Balfour studentship: but a memorial to such a man and for such objects should be international; and we are glad to learn that a representative committee of American naturalists, with Mr. Alexander Agassiz at its head, is being organized for the purpose of obtaining subscriptions to the Balfour fund. Few scientific men in this country are in a position to contribute large sums; but we trust that all American biologists will give something, whether they be investigators, teachers, or students. A general subscription from naturalists on this side of the Atlantic would be a most graceful testimony to the esteem in which Balfour's character and work are held by us; and would at the same time express our approval of the idea to make the monument of an eminent scientist not a bronze or marble statue, but a permanent endowment for the advancement of knowledge.

REARING OYSTERS FROM ARTIFICIALLY IMPREGNATED EGGS.

DURING the past three years the writer has been engaged upon the investigation of this subject, with the view of reaching some practical results which would be available in the hands of oyster-culturists. Until last year his efforts under the auspices of the U.S. fish commission had been comparatively fruitless and unsatisfactory. In July and August last, in association with Col. M. McDonald, the experimental work was resumed at St. Jerome's Creek, St. Mary's County, Maryland. Col. McDonald devised a simple combination of glass apparatus, consisting of a series of jars connected together with rubber tubing, somewhat in the manner of a series of Wolff's bottles, with an open glass aquarium at a higher level as a feeder, or reservoir, while the last jar of the series discharged into a similar cylindrical aquarium standing on the floor. The sea-water introduced into this contrivance was carefully filtered through cotton-wool, to remove all sediment and foreign organisms. The circulation was maintained in this contrivance by baling the water from the lower into the upper aquarium; the water passing continually through the intervening series of jars, which were, in effect, simply enlarged portions of the siphon-tube passing from the upper to the lower aquarium. No difficulty was experienced in keeping the water in this apparatus fresh and sweet without renewal.

On the 23d of July a batch of oyster-eggs was introduced into this apparatus, impregnated by a method to be hereafter described. On the 24th, and just about twenty-four hours after impregnation had taken place, an inspection of the transparent sides of the jars and aquaria was made; and to our great surprise we found immense numbers of embryos with the valves of the larval shell covering the sides of the body, and adherent to the inner surfaces of the glass vessels. In some places upwards of twenty-five might have been counted to the square inch. Every available part of the surface of the vessels was, however, more or less affected by these affixed embryos. Some of the jars were then taken from the closed circuit, and a continuous current passed through them, which it was found did not dislodge the embryos; but in two to three days more it was found that most had died or been detached, even in the portion of the apparatus not affected by a continuous current of fresh sea-water. The gratifying result which we had anticipated at the beginning of our experiment was, however, not realized, except in so far as it determined that fixation of the embryos took place at an early period under favorable conditions, or in about twenty-four hours, and that they might be reared from artificially fertilized ova. Efforts to repeat our first successful experiment failed, owing, probably, to the high temperature then prevailing.

The next advance made was when the writer hit upon a physical test by means of which the sexes of the spawning adults can be instantly determined by the most ignorant person. It was found, that if the ova were squeezed from the ovary, and dropped into sea-water in a glass dish resting on a dark ground, they would break up into a distinctly granular cloud; while the milt would not so readily break up, but would tend to mix slowly with the water as a milky substance, the particles of which were not perceptible to the naked eye, and, if stirred about in the water, would not break up at once, but be drawn out into wisps and streaks resembling in miniature cirrus or mare's-tail clouds. This test was an infallible guide; so much so, that a pocket-lens was found to be of no advantage, as we had formerly supposed. We also found, that if the eggs did not separate at once, when dropped into the water, they were not so mature as they should be.

Another important improvement was also in-

troduced by the writer for extracting the eggs and milt from the adults for spawning purposes. This consisted in applying essentially the same method for the extraction of the eggs as is used in spawning fish artificially; thereby avoiding the admixture of foreign matters, and fragments of the other tissues of the animal, such as occurs when the ovary is cut out, and chopped up into fragments in water. A very little experience will enable a person to find the ovary or spermary on the sides of the body of the animal when one valve is removed. Removing the mantle below and in front of the heart-chamber, its principal ducts will be exposed; and these may be traced backwards on either side of the ventral process of the body-mass to below the muscle, where the process juts into the suprabranchial chamber with its apex reaching to the commencement of the cloaca. When the spawn is abundant, the ducts are usually gorged, and look like prominent veins distended with a creamy substance.

To remove the generative products without cutting or lacerating the reproductive organs, one should be provided with a medicine-dropper or short pipette with a curved tip and a compressible rubber bulb at top. With the curved point of the pipette, the ducts of the reproductive organ are gently and firmly stroked in the direction of the external opening from before backwards. This, if properly done, will force out the eggs or the milt in a stream from the genital opening of the same side; when the pipette may be applied to suck up the extruded spawn, and drop it into water without the admixture of any deleterious foreign matters whatever. If the soft parts of the oyster have been left attached to the one valve, which I have found to be most convenient in practice, the other side of the animal may be treated in the same way, as the reproductive organ has an opening on either side of the body. To do this the head end of the animal, next the hinge, is simply thrown back over the adductor, the mantle cut open, and the spawn pressed out of the ducts of the under side as before.

By the foregoing method, which is much neater and more cleanly than any other, the best spawn is obtained; and it is often possible to impregnate fully ninety per cent of the eggs taken. When eggs so treated are placed under the microscope, comparatively few injured ones will be observed; at any rate, the result will be vastly more satisfactory than if the animal is crushed or chopped up in order to get the spawn. Many billions of eggs might be fertilized in a day by this plan.

As a result of the experience with the fixation of the embryos resulting from the artificially fertilized eggs, as described at the outset, it was determined to investigate the mode of fixation to learn if there was any uniformity about it. I now believe that the fixation of the fry is accomplished by the border of the larval mantle, the existence of byssal organs being doubtful. The oldest larval shells of artificially reared embryos have the hinges of the valves truncated and without beaks or umbos; while the fry on the eve of conversion into spat has a distinct beak to each of its valves, which projects anteriorly beyond the hinge-line. The valves, at this time, are very ventricose, quite symmetrical, and similar to Pisidium in form, or in the most marked contrast, in respect of shape, with the irregularity of the older spat and adult.

When a large number of very young natural spat is examined on their attachments, it will be found, that in every case the apex of the umbo of both the valves of the larval shell are turned towards the left if the hinge end is directed towards the north. It is therefore clear, that when the young attach themselves, they do so constantly by one and invariably the same side. Upon examining spat which has just begun to form a shelly attachment, we find this to begin at the border of the larval shell, and to grow outwards; the hinge being continued for a time laterally or on a line with that of the larval shell. We may also note, that the distal free border of the lower valve is the only part of the fry shell which comes into direct contact with the object to which attachment occurs; and that the hinge end of the larval or fry shell is directed somewhat upwards, the line of junction of the valves having at first formed an angle of nearly thirty degrees with the plane of the surface to which fixation occurred. This condition of things is so invariable that it may be regarded as universally the case. How does the fixation occur? A byssus at most would only serve for temporary anchorage; and we find, that as soon as the first calcareous deposits are formed to build the asymmetrical valves of the spat, the lower valve of the latter is for the first time glued down by the conchioline or periostracum covering it externally, and that it often continues to be so affixed until it is nearly two inches in diameter. After this the lower valve of the spat becomes free, and the free margin of the shell begins to be bent upwards. The valves of the symmetrical fry are also laminar and homogeneous in microscopic structure; while the very first layers of

calcic carbonate deposited to form the spat shell are prismatic and of a wholly different microscopic appearance from that of the fry. The facts presented above prove beyond a doubt, that it is the mantle border of the fry which is the effective agent in achieving firm fixation, whatever may be the importance of a temporary or larval byssus.

This was an interesting and important point to determine, on account of its practical relation to the artificial rearing of the American oyster (Ostraea virginica). But with the foregoing comparatively meagre results we may say, that our success in the artificial culture has ended; and, were it not for the highly encouraging recent reports from France, our efforts might have rested here. The stimulus which has provoked the investigations recently undertaken abroad was, however, probably Dr. W. K. Brooks's success with the American oyster in 1879, and his demonstration of its unisexuality.

The remarkable success of M. Bouchon-Brandely in rearing spat from the artificially fertilized ova of O. angulata at Verdon in France, as reported in the *Annals and magazine of natural history* for October, 1882, and his still later reports to the minister of marine of France in the *Journal officiel de la république française*, are of the greatest moment as applied to practical oyster-culture. M. Brandely, after determining that O. angulata was unisexual like the American species, conceived the idea of rearing the spawn by artificial means. In order to do this, two adjoining oyster claires, or ponds, fed by the tides were arranged at Verdon; the one acting as a reservoir from which the fresh sea-water (brackish) was drawn through a tube, provided with a filter consisting of a sponge at either end, into the lower experimental claire. The water percolated out of the latter through a bed of fine sand; in this way the embryonized ova placed in this pond were kept from escaping. Fertilized eggs were then put into the experimental pond from day to day, while a number of collectors, or tiles, were at once submerged in the same. In somewhat more than a month, success had attended his experiments; and in the course of further experiment still greater success was attained when about four thousand spat had been found affixed to a single tile under circumstances which admitted of no doubt as to their having been the product of the artificially impregnated eggs placed in confinement in their vicinity. It was found, moreover, that the artificially fertilized eggs had actually developed into spat in the closed claire a month before any had made their appearance on the thousands of tiles placed on the natural banks in the Gironde.

From a personal investigation of the anatomy of O. angulata, we can affirm that it is remarkably similar to O. virginica in the structure of the generative organs, and that there is no reason why as great success should not attend the culture of that species by the same apparently very practicable means. It remains to be seen, however, what proportion of the artificially reared spat will reach the adult condition. With an abiding faith, however, in the final achievement of the solution of the question of the artificial culture of the American oyster, which will soon become a positive necessity to its culture, I think it not improbable that another season's work will conclude the required preliminary research, and realize for us all the success we could hope for. J. A. RYDER.

THE MAPPEMONDE OF SEBASTIAN CABOT.

THE library of Harvard College, in Gore Hall, has recently been enriched with a photographic facsimile of the large map of the world in the national library in Paris, known as the map of Sebastian Cabot. This interesting memorial was discovered in Germany about the year 1844, in the house of a Bavarian curate, and, through the good offices of M. de Martius, was in that year purchased for the Paris library. It is a large elliptical *mappemonde*, engraved on copper, 1 m. 48 cm. in width, 1 m. 11 cm. in height. Along each side of the map, that is to say, outside the circle, is a table 30 cm. in width; the first, on the left, inscribed at the head, Tabula Prima, and that on the right, Tabula Secunda. On these tables are seventeen *legendes*, or inscriptions, in duplicate, — that is to say, in Spanish and in Latin, — printed, and pasted on the map. Each legend in Latin immediately follows the Spanish original, and bears the same number. Besides these seventeen inscriptions, there are five others in Spanish which have no Latin *exemplairs*.

This ancient map, composed, as we shall see farther on, in the year 1544, while Cabot was yet living in Spain, contains geographical delineations of discoveries down to about that period. In representing the north-east coast of our continent, Newfoundland is laid down as a group of islands; and we easily recognize the river and bay of St. Lawrence,

Cape Breton, and the Isle of St. John. The west coast of America is delineated as far north as lat. 35°, California being drawn from the well-known chart made by the pilot Castillo in 1541. To the north of this, of course, is the unknown region; for nobody then knew certainly whether America and Asia were one continuous continent, or were divided by straits, and the conjectures of geographers were at variance.

But the interest in this map centres principally in its inscriptions; and, though the most of these contain little of value in a geographical or historical point of view, a few of them are of special significance. The seventeenth inscription, by turning it into English, reads as follows: —

"Sebastian Cabot, captain and pilot-major of his sacred imperial majesty, the emperor Don Carlos, the fifth of this name, and the king our lord, made this figure extended on a plane surface, in the year of the birth of our Saviour Jesus Christ, 1544, having drawn it by degrees of latitude and longitude, with the winds, as a sailing-chart, following partly Ptolemy and partly the modern discoveries, Spanish and Portuguese, and partly the discovery made by his father and himself: by it you may sail as by a sea-chart, having regard to the variation of the needle," etc.

Then follows a discussion relative to the variation of the needle, which Sebastian Cabot claimed to have first noticed. Here we have the declaration, that the map was made by Sebastian Cabot, pilot-major of the Emperor Charles V., and in the year 1544, at which time we know he was living in Spain and held that office. And this is accompanied by the statement, that, in making the map, he was guided by the discoveries of his father, John Cabot, and himself.

Inscription No. 8 reads thus: —

"This country was discovered by John Cabot, a Venetian, and Sebastian Cabot his son, in the year of our Lord Jesus Christ, MCCCCXCIV [1494], on the 24th of June in the morning, which land they called '*prima vista;*' and a large island adjacent to it they named the Island of St. John, because they discovered it on the same day," etc.

This is an important statement made or authorized by the alleged author of the map, said in the inscription No. 17 to be Sebastian Cabot; and, though the year of the discovery expressed is believed to be a typographical or a clerical error, the whole passage bears evidence of proceeding from Sebastian Cabot himself. The body of the map itself contains numerous inscriptions, some brief, and others of greater length, with references by numbers to the legends on the sides; so that these tables belong to and are a part of the map itself. The *prima vista* of legend No. 8, or '*prima tierra vista,*' that is, the land first seen by the Cabots, is inscribed on the map near the head of the delineation of Cape Breton.

Like many of the large maps of that period, a number of figures of men and animals, the supposed natives of the countries described, are introduced into the body of the map. Savages are at war with each other, and tigers and bears are roaming over the American continent; the Emperor of Tartary is depicted in state; and Prester John, holding a cross, is placed near the great lakes, the sources of the Nile. In the original map the figures are colored. The map has no name of engraver or publisher, or place of publication. One would naturally say it was published in Spain; but the policy of the government was opposed to the publication of maps which delineated their own possessions. Dr. Kohl thinks it was published in Germany or Belgium. In one corner of the map is depicted the double-headed eagle displayed on the arms of Germany.

I do not propose to discuss in this brief notice all the questions which have arisen, or which suggest themselves, respecting the genuineness and value of this map, but simply to describe it. It can be studied now by means of the photographic copies taken, as it never could be studied before from the position of the original in the national library in Paris.

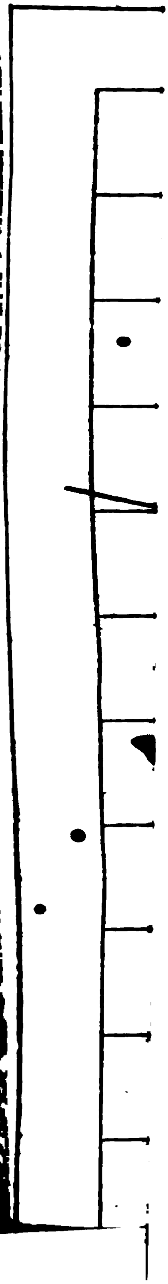
We now know, from sources independent of this map, that John Cabot, in a single vessel from Bristol, discovered North America in the year 1497. His son Sebastian may have been with him. The expedition returned in about three months. In the following year, 1498, John Cabot sailed again with a larger number of vessels, and Sebastian no doubt went with him. They had not returned by the end of October. Nobody knows when they returned, and nobody knows what became of John Cabot. Sebastian returned, and lived fifty years after this second embarkation. He or his father, or both of them, made maps at the time, illustrating the voyage of discovery; but these are lost. Writers in the sixteenth century, before Hakluyt's time, often speak of Sebastian Cabot's maps (they never speak of John Cabot), but without describing them. Ortelius in 1570 had a copy of a map by Cabot engraved on copper, without the

name of the place or printer. Yet, forty years ago, no one, for two centuries and a half, had seen a copy of a map by Cabot. When, therefore, it was announced that the National library in Paris had found a Cabot map, a great interest was excited. The distinguished geographer, M. d'Avezac of Paris, wrote a description of it in the *Bulletin de la société de géographie* (4th ser. tome xiv. pp. 266–268); and M. Jomard produced a facsimile of it, without the inscriptions, for his great work, the *Monuments de la géographie*, 1842–1862. Geographers have been trying to study it ever since; but the inscriptions had never been copied, and it required a visit to Paris to inspect them. In the glass case in which the map was shown, it was scarcely accessible for study. Having occasion last winter to make a study of the Cabot voyages, I wrote to Paris to have a copy made for me of several of the inscriptions on this map, — the greater part of which in their Spanish form were nowhere accessible. The great charge for the work was explained by the difficulty of access to the map, of which I have spoken. About this time, being in consultation with the librarian of Harvard University, — Mr. Winsor, — he suggested the practicability of having a photograph made of the map and its inscriptions. As the Hon. Robert C. Winthrop, the president of the Massachusetts Historical Society, was about to sail for Europe, the matter was laid before him; and he readily entered into the plan, and, thanks to his kind intervention during a late visit to Paris, the work was accomplished, and the photograph is a great success. The skilful photographer employed by Mr. Winthrop was M. Sauvanaud, who made for him ten copies, which have been taken by different libraries and societies in this country, dividing the expense between them.

This map has a curious connection with other historical memorials of three hundred years ago, and an interesting piece of literary history might be made of it. I will state briefly some of the points of interest. Richard Hakluyt, the great collector of voyages and travels, in a folio volume published in 1589, called The principal navigations, etc., printed "An extract taken out of the map of Sebastian Cabot, cut by Clement Adams, concerning his discovery of the West Indias, which is to be seen in her Majesty's privy gallery at Westminster, and in many other ancient merchants' houses." The 'extract' which follows this heading is in Latin, and is in substance the same as legend No. 8 on the Cabot map in Paris, from which I have made a quotation above, relating to the discovery of unknown lands. I say it is in substance the same; but the grammatical construction is quite different, indeed, so very unlike that I suggested some years ago that the Latin of the Paris map and the Latin of Clement Adams, or that which he copied, were independent translations from a Spanish original. Now, here we see another Cabot map in London, from which Clement Adams, a learned schoolmaster, made copies, with the same legends upon it in Spanish, or in Latin, or in both; if in Latin, quite different from that on the Paris map. Possibly it had only the legends in Spanish, and Adams made his own independent translation, as suggested above.

Again, in 1594, — second edition, 1599; third edition, 1606, — there was published a rare and curious volume, edited by a German traveller, Nathan Kochhaf, or, as he was called by his Latin name, Chytraeus. He was in England in 1565, picking up whatever of antique and curious legends and monumental inscriptions he could find for his book; and while apparently at Oxford, he saw a document, with some geographical tables, containing several inscriptions in not very elegant Latin, he says, but which, on account of the value of the matter contained in them, he copied and printed in his volume, filling twenty-two pages of this book. They are wholly in Latin, and they correspond substantially with the Latin inscriptions on the sides of the Cabot map in Paris. There is this difference: The inscriptions here are but nineteen in number, while on the Paris map there are twenty-two, five of them in Spanish only. Legend No. 17, which I have quoted above in part from the Paris map, has the date 1549 inserted as the year in which the map to which the inscriptions belonged was composed; instead of 1544, as on the Paris map. This which Chytraeus saw may be a second edition of the Paris map, made after Cabot had returned to England. So here, again, we have another Cabot map to be added to our cartographical bureaux, along with that of Clement Adams and the map from which he made his copies, which were hanging up, in Hakluyt's time, 'in many ancient merchants' houses,' — all of which we must class with the *desiderata*.

I have spoken of the volume of Chytraeus, which contains substantially the legends as on the Paris map in Latin. The language in which the legends were originally written was Spanish; and on the Paris map, as I have already said, they appear in Spanish as well



Nos. 7 to 13 ; an extra reel with 5,900 fathoms

sity of Cincinnati, before the Ohio mechanics' institute, Jan. 18, 1883.

[2] Phil. mag. [4], vol. 40, p. 122.

name
ago,
had s
theref
library
great i
geogra
descri
de gé
268);
of it,
work,
1862.
it eve
been
to ins
the m
ible f
to m
wrote
sever
great
were
for th
acces
Abou
the l
Wins
havin
its in
throp
torica
the n
enter
inter
work
is a
empl
who
take
this
then
Th
othe
year
histo
brief
Hak
trav
calle
"A
tian
ing
is t
Wes
chan

this heading is in Latin, and is in substance the same as legend No. 8 on the Cabot map

Spanish; and on the

already said, they appear in Spanish as well

as in a Latin version. By means of these photographic copies of the map, the legends in Spanish are made accessible. I am not aware that they have ever been published as a whole. There is something more than a suspicion that some of the legends in Latin contain statements not to be found in the Spanish. A committee of the Massachusetts historical society, to whom a copy of this map, presented by the president, has been referred, intend to publish an English translation of the legends, with the result of a comparison with the Latin version.

CHARLES DEANE.

MAP OF THE PLANETS AND STARS NEAR THE SUN, MAY 6, 1883.

THE map which is given in this number of SCIENCE has been prepared to aid astronomers, who may observe the total solar eclipse of this year, in a search for Vulcan. It does not need to be said that the eclipse of May 6 is the most favorable for this purpose that will occur for many years, and it is to be hoped that the unique opportunity will not be lost.

The present map has been compiled with care from the *Durchmusterung* catalogue, checked by comparison with the maps and by proof-reading. It contains all the stars of the *Durchmusterung* within the region near the sun, down to the seventh magnitude inclusive, together with a few stars of a slightly lower magnitude, which are only added when their omission would spoil a configuration. The planets Saturn and Neptune are also added. The positions of the map are amply accurate for the purpose intended.

EDWARD S. HOLDEN.

Washburn observatory, university of Wisconsin, Madison, Jan. 11, 1883.

FIRST USE OF WIRE IN DEEP-SEA SOUNDING.

IN view of the great impetus recently given to deep-sea sounding and dredging (especially in the United-States navy and coast survey work) by the application of steel piano-wire in place of line, it is interesting to learn the fate of the first experiments in that direction. These have been extracted by Commander J. R. Bartlett, U.S.N., of the hydrographic office, from the log-book of the United-States schooner Taney, Lieut. J. Walsh, U.S.N., commanding, October, 1849, to June, 1850.

The Taney took on board at the Brooklyn navy-yard, Oct. 22, 1849, a large iron reel containing 7,000 fathoms iron wire graduated Nos. 7 to 13; an extra reel with 5,900 fathoms wire, size not stated; and a small reel with 300 fathoms iron wire, size No. 5.

The Taney sailed Oct. 26, 1849, to take deep-sea soundings in the North Atlantic. On the 15th of November preparations were made for sounding with wire in lat. 31° 59′ N., long. 58° 43′.5 W., not far from Bermuda. After reeling out 5,700 fathoms, the wire parted near the surface, owing to the fact that the splices had some projecting ends which caught upon each other. The No. 7 wire parted. It is noted in the log, that the circumstances were favorable and the sounding plumb. It seems, however, that the lead used was altogether too small, about twelve pounds only; and this was the reason why so much wire ran out without its being recognized that bottom had been reached. The weight of the wire of course carried it out, and would have continued to do so as long as any wire was left. The lead was armed with a Stellwagen cup, but the detaching apparatus and dynamometer for sounding were then unknown.

The same experience was repeated on the 9th of May, 1850, when 2,200 fathoms of wire were lost; and on the 18th, when 2,050 fathoms were lost, with the thermometer, twelve-pound lead, and Stellwagen cup. On the 22d of May the last attempt was made with the same results; the wire parting in every instance owing to one splice catching upon another on or near the reel. The last time only an eight-pound lead was used, with 1,900 fathoms of wire out when it parted. The party returned to New York, June 3, 1850, shortly after which Lieut. Walsh died. This ended the trial of wire for the time; to be revived when the invention of steam reeling-apparatus, detaching sounding-cups, the dynamometer, and 'accumulators' had rendered its use practicable. It seems singular, however, that the difficulty as to the splices was not remedied on the spot, and that heavy leads were not tried.

WILLIAM H. DALL.

AN EXTENSION OF THE THEOREM OF THE VIRIAL AND ITS APPLICATION TO THE KINETIC THEORY OF THE CONSTITUTION OF GASES.[1]

CLAUSIUS has designated as the theorem of the virial the equation which he first arrived at in a paper upon a *New mechanical theorem applicable to heat*.[2] This theorem applies to stationary progressive motion, such as the molecules of gases are assumed to have in the kinetic theory of gases, and, when so applied, may be written in the form

$$akt = \tfrac{3}{2}pv + \tfrac{1}{2}\Sigma rR \quad . \quad . \quad . \quad . \quad (1)$$

[1] Abstract of a paper read by H. T. EDDY, Ph.D., University of Cincinnati, before the Ohio mechanics' institute, Jan. 18, 1883.

[2] Phil. mag. [4], vol. 40, p. 122.

in which p, v, and t denote the specific pressure, volume, and absolute temperature of the gas; k is the specific heat at constant volume; a expresses what fraction of total kinetic energy, kt, is progressive; r is the mean distance of the molecules; and R the mean intermolecular attraction; the summation being taken for all possible pairs of molecules.

This investigation depends upon d'Alembert's equation expressing the relation of the force acting to the linear acceleration of the mass moved.

The present paper proceeds to employ Euler's equation, expressing the relation of the couple acting to the angular acceleration of any material body, to find an analogous equation for the mean rotary motion of bodies in a state of stationary rotation. An equation is obtained precisely analogous to that found for progressive motion. But, since the intermolecular attractions cannot accelerate the rotary motion, they do not appear in the equation, which can finally be written in the form

$$a'kt = \tfrac{3}{2} pv \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

in which a' expresses what fraction the mean rotary energy is of the total kinetic energy. Two cases, however, must be excepted from the general equation (2). The first of these is that of molecules which are smooth figures of revolution, such as diatomic molecules may be supposed to be; and the second is that of smooth spheres, such as monatomic molecules may be. In these two cases it is shown that

$$a'kt = pv, \text{ and } a'kt = 0,$$

respectively.

It is further shown, that, in case a variation of state occur, that the variation of the last term in (1) must be always negative, or zero, when the temperature is augmented, as appears from comparisons of the formula with Thomson and Joule's experiments on the free expansion of gases in passing a porous plug, with Andrews's experiments on carbonic-acid gas above the critical temperature, with Berthelot's principle of maximum heat, and with mechanical systems in motion under the control either of gravitation or of elastic forces.

An investigation is then made of the ratio of the specific heat at constant pressure to that at constant volume in imperfect gases; the result of which, for molecules of more than two atoms, may be expressed in an equation of the form

$$k = \tfrac{4}{3} - \tfrac{1}{3}b + \tfrac{1}{6}(5 + i)c \quad . \quad . \quad . \quad . \quad (3)$$

in which k is the ratio of the specific heats in question; b expresses what fraction of the total kinetic energy exists in the form of atomic vibration within the molecule; c, which is very small, expresses what fraction the work done against intermolecular attractions is of the same quantity; and i is the exponent expressing what inverse power of the distance between the molecules may be taken as the approximate law of intermolecular attraction. i is always taken as greater than unity, and usually greater than 3; while the value proposed by Maxwell is 5. The experimental values of k lie between 1.33 and 1.25. If the value of c be assumed to be zero, as it is in perfect gases, then a lies between zero and $\tfrac{1}{4}$; and, if c is not zero, a must exceed $\tfrac{1}{4}$ for some of the more complex gases; i.e., the energy of vibration of the atoms within the molecules may exceed one-fourth of the mean kinetic energy of the gas.

In the case, however, in which the molecules consist of but two atoms each, the equation obtained is

$$k = \tfrac{7}{5} - \tfrac{2}{5}b + \tfrac{1}{5}(4 + i)c. \quad . \quad . \quad . \quad (4)$$

in which the value of b must be much smaller than when the number of atoms is larger. The experimental values lie between 1.41 and 1.39; and for air, for which k has been more accurately determined than for other gases, the accepted value is, according to Wüllner, 1.405; in which the influence of the term containing c is perceptible. The value, however, of k, derived from Regnault's most accurate determination of the velocity of sound, is 1.395. For molecules consisting of one atom each, the equation obtained is

$$k = \tfrac{5}{3} - \tfrac{2}{3}b + \tfrac{1}{3}(2 + i)c. \quad . \quad . \quad . \quad (5,$$

The experimental value of k, as found for vapor of mercury (the only known monatomic gas), by Kundt and Warburg, is 1.67.

This ratio has been previously investigated by Boltzmann and by Watson, by the help of generalized co-ordinates expressing the number of degrees of freedom of the system; but it has not been found possible to assume any integral number of degrees of freedom which would cause the value found for k to agree with experimental results. The opinion is expressed by the author, that this method is unsuited to the investigation of this question, because any elastic connection or attractive forces neither allow perfect freedom, nor impose absolute restraints, such as are contemplated by the method.

So far as known, this investigation explains, for the first time, what Watson, on p. 39 of his treatise, regards as "the great difficulty in the establishment of the kinetic theory of gases on the molecular hypothesis."

CONSEQUENCES OF SPLEEN EXTIRPATION.

IN a preliminary notice (*Centralbl. med. wissensch.*, 1882, 900) Winogradow describes the results of spleen extirpation, as manifested in the blood, lymphatic glands, and bone-marrow of dogs, several of which were kept alive in good health for more than two years after the splenotomy.

After the operation the number of red corpuscles in a cubic millimetre of blood always falls in a short time, occasionally within a few days. This diminution is most marked from a hundred and fifty to two hundred days after the splenotomy, when in some cases the red corpuscles are less than half their normal number. Later they become again more abundant. In the first twelve months the size of the red corpuscles is not altered: after that there is found a gradually increasing proportion of abnormally small specimens; and the red corpuscles of exceptionally large size, of which some are always found in normal dog's blood, entirely disappear. The white blood corpuscles show no morphological change; their absolute number is sometimes increased, sometimes diminished.

In one case, a hundred and thirty-two days after the splenotomy, there was found marked enlargement of most of the lymphatic glands. They were much softer than normal, and red on section, especially in the cortical layer, looking much like splenic tissue. This coloration depended mainly on red blood corpuscles which were abundant in the lymph channels of the gland; and was in part due to deposits of brownish-red pigment, which Winogradow ascribes to the detritus of broken-down corpuscles.

The marrow in the central cavity of nearly all the long bones was red-colored, and presented the general appearance of the red marrow of the cancellated bony tissue of young dogs. This color was due to red corpuscles lying outside the blood-vessels in the spaces of the proper marrow tissues.

Later (five hundred and seventeen to seven hundred and sixty days after the spleen removal) similar but less marked divergences from the normal struc-

ture were found in both the lymphatic glands and the bone-marrow.

The blood of a dog which has undergone splenotomy, when transfused into the vessels of another dog, causes in the lymph-glands and bone-marrow phenomena similar to those above described. The author thinks they are in the main due to increased extravasation (? *diapedesis*) of red blood corpuscles.

H. NEWELL MARTIN.

THE CACHAR EARTHQUAKE OF 1869.

THE Geological survey of India publishes in vol. xix., part i., of its memoirs (1882), an account and discussion of the Cachar earthquake of north-eastern India, Jan. 10, 1869. The observations were made and the study begun by the late Dr. Thomas Oldham, then superintendent of the Survey: the work is lately completed by his son, R. D. Oldham, now a member of the geological corps The memoir gives a general account of the shock and its destructive effects; notices of previous descriptions by Oldham, sen., Godwin-Austen, H. F. Blanford, and Archdeacon Pratt, which in the present view seem largely erroneous in their theoretical parts; and a discussion of the position, depth, and shape of the seismic area, and the velocity of the earth-wave's motion and translation. It is well illustrated by photographs, lithographs, diagrams, and maps.

Cachar (or Silchar), where the shock produced great destruction, and after which it was named, is a town on the Barak river, at the southern base of the rainy Jaintia hills, about 300 miles north-east of Calcutta. The seismic vertical was some 80 miles farther north, as determined by thirty-six intersections falling within an area forty miles by four or five; or, excluding the less satisfactory lines, on an area twenty miles by three or four. The depth of the focus is estimated from several tolerably accurate observations at two stations, at thirty miles — or somewhere between twenty-five and thirty-five miles — below the surface. The area over which the shock was felt was an oval measuring 650 miles north-east and south-west, and 400 miles across, covering 250,000 square miles, and including Patna and Hazaribagh on the west; the Ganges delta and Chittagong on the south; the head waters of the Namtonai (branch of Irrawaddy) on the east; and the southern slope of the Himalaya on the north. In the latter direction, the extension of the shock was not determined. Within this, a smaller oval or isoseismal line is drawn to show the region of great destruction; this is symmetrically placed around the seismic centre. The velocity of wave-translations, estimated over a difference of seismic radii of 180 miles,[1] was 1.2 miles a second, which is regarded as very high and improbable, although the observations on which it is based — chronometer time noted by Major Godwin-Austen in the hills forty miles north-east of Cachar, and the clocks stopped by the shock in the surveyor-general's office in Calcutta — seem trustworthy. The wave-motion, even at a distance of eighty-five miles from the seismic vertical, was thirty feet a second; decidedly greater than that found by Mallet for the Neapolitan earthquake of 1857. The large value of the angle of emergence at Cachar is ingeniously accounted for as a result of upward refraction of the wave in passing through the loose alluvial sands. In spite of the violence of the shock, few lives were lost, and few buildings overthrown: the reason being that most of the houses are of wood and bamboo, elastic enough to escape great injury; or, if of masonry or brickwork, the walls are heavy and low, supporting each other against overthrow. A church-tower, a saw-mill, and a two-storied palace were thrown down. A secondary action of the shock produced greater destruction at certain points. The alluvial deposits along the river-bottoms sometimes contain strata of soft, water-logged quicksand; and where the heavy clays overlying these are cut through by the streams, they are often cracked parallel to the steep bank by the earth-wave, and then settle down, and slide on the soft sands beneath. If this happen in a village, the buildings are torn to pieces by the differential motion of their foundations, even if able to escape the effect of the shock. Connected with this effect is the formation of 'sand-craters,' which are shown to result from the wet quicksand being forced up through a vent or crevice opened in the overlying clays; the open cup-like form being produced by the back-flow of the water after the shock passes on. These are finely illustrated, and at once recall the figures given in Lyell's 'Principles' of the 'circular hollows' formed on the Calabrian plains by the earthquake of 1783.

The memoir closes with an appendix giving simple instructions for earthquake observations, and we cordially join the author in the hope that such observations may soon be undertaken at the meteorological stations throughout the earthquake districts of India.

W. M. DAVIS.

[1] There seems to be an error of 100 miles in the distance of Calcutta from the seismic vertical given on p. 84. Correcting this, there would be a difference of 280 miles between the two seismic radii in question, and the velocity of wave-translation would rise to about two miles a second, — even more excessive than is given in the text.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

A class-room experiment.

The class experiment commonly employed for demonstrating chemical decomposition consists in heating mercuric oxide, and showing that oxygen is given off while mercury remains behind. An easier and equally beautiful experiment may be performed with crystallized copper formate. This salt, when heated over a gas-flame in a dry test-tube, readily decomposes; oxides of carbon are evolved, and a brilliant residue of metallic copper is left. The formate is easily prepared by boiling copper oxide with formic acid, and filtering. On cooling, fine blue crystals are deposited. Although this experiment involves no new facts, I believe its applicability to class-room purposes has been generally overlooked.

F. W. CLARKE.

Domestic ducks that fly abroad like pigeons.

Facts relating to the history of the domestication of animals are so rare that it is highly important to keep them in view when once they are presented. In this category may be placed O'Donovan's account of the domestic ducks of the Caspian Turcomans. He noticed, especially in the villages bordering upon the south-eastern coast of the Caspian Sea and the Atterex delta, that great flocks of ducks are reared by the inhabitants.

"But so nomadic are the habits of these birds, and so strong are they upon the wing, that it is all but impossible to distinguish them from their wilder brethren that people these solitudes in such vast numbers. I have frequently been astonished at seeing what I took to be a crowd of fifty or sixty mallards come flying into the midst of the village, and, forming in some open space, proceed to march in serried files into the hut devoted

to them; and I have called down the wrath of the inhabitants upon my head by discharging my gun at them. They fly away for miles along the coast, keeping themselves carefully separated from the wilder sea-birds, and invariably return to their domicile at a certain hour in the evening." — (*The Merv oasis*, i. 159.)

Can any of your readers state to what species of duck reference is here made? and are any similar facts regarding domesticated or semi-domesticated ducks on record? F. H. STORER.

POOLE'S NEW INDEX.

An index to periodical literature. By William Frederick Poole, LL D. 3d edition, brought down to January, 1882, with the assistance, as associate editor, of William I. Fletcher, and the co-operation of the American library association and the Library association of the United Kingdom. Boston: J. R. Osgood & Co., 1882. 1442 p. Large 8vo.

THE appearance of a new edition of Poole's Index to periodical literature is not only an event of literary importance, but a matter of some moment to science as well. In recent times, literature and science have grown so close together that the student of one cannot well ignore the other; and a glance at the work before us will show how impossible it is to draw between them any sharp dividing-line. Of course it was not the purpose of the editor to index the periodicals of a purely technical kind; but popular science seems to have been included in his plan. Accordingly we find such journals as Silliman's, Nature, the American naturalist, the Popular science monthly, the Anthropological review, the Journal of the Franklin institute, the Mathematical monthly, Van Nostrand's engineering magazine, the Edinburgh philosophical journal, etc., exhaustively treated. Others of equal importance are omitted; but enough are included to make the volume one of real value to every worker in science, whether he be mathematician, astronomer, physicist, chemist, naturalist, geologist, or engineer. The sins of omission count for nothing when balanced against the solid merits of the enterprise. The arrangement of the work is entirely by topics; and its extensiveness may be illustrated by the fact, that between the titles 'electric animals' and 'electrotype,' there are over two hundred and fifty distinct headings, and a large number of sub-entries besides. Many of the titles represent work by the most eminent electricians of the century.

To the student of science the volume, apart from its references to scientific journals, has two points of special interest. First, it contains what is wholly wanting in catalogues of scientific memoirs; namely, abundant material concerning the personality of scientific men. If one wishes to study the life and influence of Faraday, Humboldt, Agassiz, or Henry, here he will find references to a multitude of papers; such as biographical notices, obituaries, criticisms, sketches, and so on. In nearly every magazine, whether monthly or quarterly, matter of this kind is to be found; and Poole's Index gives us a systematic key to the entire mass of it. The saving of time to the student can hardly be estimated, and the value of the material thus rendered available is by no means small. Whatever great work a master in science may have done, we can better appreciate it if we know something of himself and his environment. Whenever, in studying a mooted question, we try to assign weight to differing authorities, it is worth while to get at some knowledge as to the personal equation of the men. This is particularly true with regard to the bitterer controversies.

The second point of interest above referred to is the evidence which the Index offers as to the extraordinary influence which science exerts, even upon journals which are ostensibly quite outside of its own domain. Every one of the leading magazines is subject to this influence. We find symptoms of it in the scientific references scattered through literary, philosophical, and political essays, and in the host of papers in which science is sought to be popularized. Even poetry, which some critics assert is independent of and above science, is getting to be full of scientific allusions. Many of the popular essays upon scientific themes have solid and permanent value, and yet they are not recorded in such catalogues as that of the Royal society. Only in this volume can we get readily on the track of them; and here we find the names of Herschel, Tyndall, Huxley, Faraday, Helmholtz, Agassiz, and many others, to whom science seemed a matter of human interest, rather than a secret chamber to be entered only by the initiated. Some of the papers here cited contain the first germs of great ideas; others represent the earnest efforts of discoverers to bring their work before the wider public; still others are pleasant summaries of recent scientific advance arranged by appreciative teachers. Whatever a truly competent investigator has to say is likely to be worth hearing; and even his colleagues may gain a clearer conception of his thought by listening to his attempts at popular simplification. Mr. Poole and his associates deserve the hearty thanks of all workers in science for the service he has done their cause.

SIR CHARLES LYELL.

Life, letters, and journals of Sir Charles Lyell, Bart., Author of Principles of geology, etc. Edited by his sister-in-law, Mrs. Lyell. In two volumes, with portraits. London, *Murray*, 1881. 457, 489 pp. 8vo.

I.

ALTHOUGH it has been more than a year since these volumes appeared, they have remained without any critical presentation to the American public. Science, like the rest of our modern life, goes so fast that there is scarce time for us to remember the dead of a decade ago. Thus it has seemed perhaps hardly worth while for our American journals to notice these admirable volumes. But it is not well for Americans lightly to pass by an admirable life of one who not only laid the solid foundations of the science in whose paths they have done so much good work, but who gave to their land and their people a patient study and a sympathetic understanding in days when other foreigners denied them both. Those who know the field of American travels will all agree that this country never had a juster or more loving critic than Charles Lyell. His two series of travels in this country, descriptive of his first and second visits to the United States, remain the best picture of American life in those years of imperfect promise, the fifth and sixth decades of this century. He made third and fourth voyages to this country, and on each of his journeys travelled extensively in the region east of the Mississippi. His papers on the geology of this country are among the most valuable contributions made by any European to the understanding of American geology; while the frequent references to American geology in his 'Principles' have served to make other parts classic localities in the science. These acts should be enough to warrant us in giving a careful study to his life, even if his peculiar place in the history of his science did not make him the most notable among all the great laborers in its fields.

It is, however, when we consider the place of Charles Lyell in the combination of sciences we call geology, that we find his true interest for all those who care for the progress of learning. No one conversant with the development of geology during this century, which includes its growth from the very germs of the science, can hesitate to give him the very first place among its many strong leaders, — a place that is unique in the history of the several sciences. The peculiarity of his position consisted in the fact that he was, during the forty years in which the science was taking its shape, an admirable critic of its work, — one who, from the circumstances of his position, his large social power, his penetration, sympathy, and capacity for individual research, was able to enforce moderation and judgment on all the workers on two continents.

When Lyell began to write the first of the eleven editions of his 'Principles' in 1828, geology was still contending with those prejudices which had retarded its progress, barriers which he, with the acumen of Bacon in dealing with the 'idols,' managed so well to overcome. In the immeasurable past which the recent researches of geologists had revealed, all sorts of speculations had been carried: vast deluges, periods of intense volcanic activity, epochs of sudden destruction and re-creation of animal life, were given room there. The aim of naturalists seemed to be to create a world as unlike that of to-day as it was possible to have it. The critical humor of Hutton or of William Smith had given place to a rage for speculation. On the other hand, the church, especially in England, had set its face against all theories that promised to weaken the dogmas of seven days' creation or the Noachian deluge. Lyell was the only geologist of his day who could have saved the science from the dangers of vagariousness that promised it a long period of trouble. Circumstances had favored his early training for the peculiar work he was to accomplish. His father was a Scotch gentleman of fortune, who had a strong taste for natural history, and made something of a name as a botanist. In his early youth Charles Lyell became deeply interested in collecting insects, — a taste which he seems to have kept during his life. As this collecting was done with discretion and study, it developed in him a power of close discrimination that was the foundation of much of his good work: no other study is so well fitted as is entomology to develop this capacity for details which is the condition of all good work in science.

After the usual rough training in humanity and the humanities in the preparatory schools, — a training that fortunately awaits every well-born British youth, — he went to Oxford, at the age of seventeen, and matriculated at Exeter College. There he laid the foundations of that excellent knowledge of the classics for which during his whole life he was distinguished above all of his scientific brethren. At every step in his future work we see the admirable results of this broad culture, this sense of perspective in the intellectual history of mankind, which is perhaps more necessary for the well-developed man of science

than for the student in any other field. It is this sense of the oneness of human history, this sympathy and understanding of men of all times, that gives the charm to his immortal Principles of geology; and in this day, when we are debating as to the use of classical training, it is well to ask what this book would have been if the Oxford element had not been there. It would perhaps have an equally valuable body of fact, but the informing spirit would have been wanting.

His power to make avail of his Oxford life was doubtless due to his keenness of appreciation of all forms of intellectual stimulus, though he took a fair rank in his college, winning second honors in classics. We see in his letters home that he has a lively interest in music, which had been an early-developed taste; for in his schoolboy days he had been the leader of a schoolboy orchestra. He is also something of a versifier; and some of his verses show a delicate fancy, though by no means a strong wing.

His first acquaintance with geology seems to have been made through Bakewell's Geology, which he found in his father's library; and that author's account of the earth's antiquity appears to have first aroused his curiosity to know more of the subject. While he was at Oxford, Buckland was at the height of his singular popularity. His lectures affirmed this early-acquired taste. His first geological journey was to Yarmouth, where he saw the great cutting power of the sea on that soft-cliffed coast. In the same year a journey to Staffa, of which his journal is given, served to possess him of the love for field-work. In 1818, when he was just of age, he made a tour through France, Switzerland, and Italy as far as Rome. His journal showed the keenest appreciation of the ordinary nature of travel, but as yet but little interpreting power. He appears, as were all others of his time, strangely blind to the structure of the Alps: even the parallel moraines on the glaciers puzzle him, — a matter that is one of the most transparent things in their history. The motion of the glaciers is not seen to be a problem: yet his critical spirit is awake; for, one of his party finding in an album the lines, —

> "Mont Blanc is the monarch of mountains:
> They crowned him long ago,
> Enthroned in ice, with robes of clouds,
> And diadem of snow," —

he well says, "It contains more real poetry than I thought could be found in all the albums of Europe." He did not recognize that they, a little garbled, were from Byron's Manfred, which had been published the year before. It may be that it shows us the place of birth of these the finest lines in that strange dramatic poem. Despite the veil that hid the deeper secrets of the Alps from his eyes, his good fortune showed him many things which served to lead his mind to the notion that the present forces of the earth are strong enough to explain the past. He saw the Goldau *éboulement*, or landslide, then but a dozen years old; and in the Rhone valley he beheld the frightful marks of the flood which poured from the lake formed by the Glacier de Bagne but six weeks before his coming.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

GEODESY.

Length of a nautical mile. — In common parlance, the length of a nautical mile is considered as a 'minute of latitude,' without any consideration of the range of value included within this definition. A paper upon this subject by Prof. J. E. Hilgard, superintendent of the Coast and geodetic survey, has just been published. It gives the values of one minute under nine different definitions. The values are based upon the elements of the Clarke spheroid. One minute of latitude at the poles = 1,861.655 metres = 6,107.85 feet; one minute of latitude at the equator = 1,842.787 metres = 6,045.95 feet; one minute on the equator (considering it as a circle) = 1,855.345 metres = 6,087.15 feet.

As adopted by the Coast and geodetic survey and by the Hydrographic office, a nautical mile is *one-sixtieth part of the length of a degree on the great circle of a sphere whose surface is equal to the surface of the earth.* Using the Clarke spheroid, this definition gives a nautical mile = 1,853.248 metres = 6,080.27 feet. This value closely corresponds with the English admiralty knot of 6,080 feet. — (*Rep. U.S. coast surv.*, 1881, app. 12.) H. W. B. [172

Night signals for geodetic work (by Mr. O. S. Wilson of the N.Y. state survey). — Owing to the small number of days during any season when the air is in good condition for sighting points more than twenty-five miles distant, and the few hours during even good-seeing days available for such geodetic work, especially in measuring horizontal angles, it is important not only to use to the best advantage what daylight is available, but also if possible to lengthen every good-seeing day. Hence any device for continuing work during clear nights is of great value. For this purpose electric lights were used on the triangulation carried across the Mediterranean in 1879 by the French and Spanish governments, with remarkably good results; the error of closure of a triangle being but a trifle over one second of arc. Some of these lines were the longest ever sighted for geodetic purposes, one of them being 167.7 miles. The burning

of magnesium-wire, fed by clock-work, in the focus of a parabolic reflector, gives an excellent light; but this, like the electric light, is too expensive for ordinary geodetic uses. The U.S. coast and geodetic survey has used kerosene student-lamps in place of the magnesium wire in connection with parabolic reflectors, on lines of twenty-five miles, with satisfactory results. At a station in Virginia, occupied by C. O. Boutelle, angles measured by day were duplicated at night, and the mean error of the night-work was only two-thirds of that done in the daytime.

In 1881 Mr. Wilson procured a small locomotive head-light with a twelve-inch reflector, and two cast semaphore lenses, one twelve and the other fourteen inches in diameter. Each of these lenses was mounted in the end of a box in which a kerosene-lamp with a 'mammoth-leader' burner was placed at the focus of the lens. These three lights, being set near each other, were readily seen through a small telescope at a distance of thirty-five miles, and little if any difference of brilliancy was detected. The magnesium apparatus and the locomotive head-light each cost about thirty-five dollars; but the magnesium wire being expensive, and this light requiring constant attention, the cost of maintaining it is several times greater than that of operating the locomotive head-light. The cost of a semaphore lens mounted in a galvanized-iron box is from ten to fifteen dollars, according to the size. The expense of maintaining it is small, — not more than fifty cents a night, kerosene being cheap, and no attention being required after the lamp has been properly trimmed, and lighted a short time. These lamps have been seen by the naked eye at a distance of forty miles.

In order to diminish as little as possible the light in the field of the telescope, a series of mirrors was so arranged upon and within the tube as to illuminate the wires, and leave the field dark. It is believed that this has not before been done with small telescopes, the one used in this instance having an aperture of only two and a half inches. Kerosene hand-lamps, protected for use in the wind, were devised and successfully used for reading the circle and illuminating the wires. The night observations thus made at state survey stations in 1882 were apparently fully equal to those taken in the daytime by means of heliotrope signals; and about half of the primary observations were actually made in the time thus saved.

For readily finding a distant signal light at night, a reference lantern was placed a short distance from the observing-station. By this, rough settings were made for the signal-light needed, which could then be brought into view by a slight vertical movement of the telescope. — (*Alb. inst.; meeting* Jan. 30.) [173

MATHEMATICS.

Conjugate quadrangles. — M. Stephanos, in seeking to généralize a kinematical proposition announced by M. Tchekychef in his memoir *Sur les plus simples systèmes articulés qui fournissent un mouvement rectiligne approximatif au quatrième et au cinquième ordre* (St. Petersburgh, 1881), has arrived at a number of properties of conjugate quadrangles. M. Stephanos defines conjugate quadrangles as being formed by two systems of four points (A_1, A_2, A_3, A_4), (B_1, B_2, B_3, B_4), when, being placed upon a plane in any manner, without altering their respective dimensions, the corresponding points (A_i and B_i) form four pairs of conjugate points with respect to a circle. There is an infinite number of quadrangles B, conjugate to a given quadrangle A; and all of the B-quadrangles are similar one to another. If A and B are two conjugate quadrangles, the areas of the triangles A_2, A_3, A_4, etc., are proportional to the areas of the triangles B_2, B_3, B_4, etc. The respective ratios are denoted by $\lambda_1 : \lambda_2 : \lambda_3 : \lambda_4$ with $\Sigma\lambda_i = 0$. λ_1, λ_2, and λ_3 are given in terms of the cotangents of the angles of the triangles A_2, A_3, A_4, and B_2, B_3, B_4. Considering two conjugate quadrangles A and B situated in the same plane, and denoting by ρ_1, ρ_2, ρ_3, ρ_4, the distances between corresponding summits, it is shown, that, whatever be the relative positions of the two quadrangles in the same plane, we have always the relation: —

$$\lambda_1\rho_1^2 + \lambda_2\rho_2^2 + \lambda_3\rho_3^2 + \lambda_4\rho_4^2 = C;$$

where C is a constant depending only on the dimensions of the two quadrangles. — (*Comptes rendus*, Oct. 16, 1882.) T. C. [174

Conical umbilics. — The following is taken from a report by MM. Bouquet and Jordan upon a memoir presented by M. de Salvert to the Academy of sciences. M. de Salvert studies the sections of a surface F $(x, y, z) = 0$, in those singular points where the tangent cone is of the second degree by planes passing through the axis of the tangent cone. Each section consists of two branches crossing at the multiple point, and having for tangents in this point the two opposite generatrices of the cone: it is proposed to find the curvature of these two branches. The author finds a formula for this curvature, of which he shows the analogy to the known expression for the determination of the radii of curvature of a normal section at an ordinary point. An application is made to the case of the wave surface, and then the author seeks the necessary conditions that the assumed point shall be a conical umbilic: i.e., a point such, 1°, that the tangent cone shall be one of revolution; 2°, that the branches of the curve which correspond to its different generatrices shall all have the same curvature. The first of these conditions leads only to known results; the second introduces six new equations involving the third derivatives of F. — (*Comptes rendus*, Jan. 8, 1883.) T. C. [175

Subdeterminants of a symmetric system. — In July, 1882, Prof. Kronecker presented to the Berlin academy a memoir in which he established certain linear relations between the subdeterminants (minors) of a symmetric system. M. Runge deals with the same subject in the present paper, and claims to show that relations found by Kronecker are the only ones existing, inasmuch as all others can be expressed by linear combinations of Kronecker's relations. He also finds a method for the determination of a system of linearly independent subdeterminants in terms of which all the remaining subdeterminants of the same order are linearly expressible. — (*Journ. reine angew. math.*, xciii. 1882.) T. C. [176

Ternary quartics. — In continuation of his researches on the ternary quartic $x_1^3, x_2 + x_2^3 x_3 + x_3^3 x_1$, and on systems of conics, Prof. Gordan discusses the typical representation of the system formed by this quartic and a conic. He finds that the coefficients in this representation are entire functions of only twelve simultaneous invariants, five of which are expressible as rational functions of the other seven, which are themselves connected by an algebraic equation of the sixth degree; and all these relations are explicitly given. These relations reduce the number of independent invariants to six, which is evidently the actual number. The last part of the article is devoted to the solution of the converse problem of determining a conic when the invariants above mentioned are given. — (*Math. ann.*, xxiv. 1882.) F. F. [177

Equations of the seventh degree. — In this paper, Prof. Gordan applies the results obtained by him

in the paper noticed above to the solution of those equations of the seventh degree in which a certain function of the roots is unaltered by a group of 168 substitutions. Such equations arise in connection with the modular equations of elliptic functions, and had been previously studied by Hermite, Klein, and others. Klein had pointed out that their treatment should be made to depend upon the investigation of the system formed by a certain ternary quartic, which is transformed into itself by a group of 168 substitutions and an arbitrary conic. It was this which led Gordan to undertake his researches upon that system. In the present paper he forms certain seven-valued functions of the coefficients of the arbitrary conic; the sums of the powers of these functions are, in virtue of a general theorem previously proved, rationally expressible in terms of the fundamental invariants of the system; and the fundamental invariants are rationally expressible in terms of the sums of the powers. The seven quantities, then, being regarded as the roots of a given equation, the invariants in question become known, and the solution of the equation is reduced to the problem of finding the coefficients of the arbitrary conic when the invariants are given; the solution of which problem is contained in the preceding paper (No. 177). The whole investigation is extremely long and difficult; and Prof. Gordan announces his intention of recasting the method by which he obtained his results, and giving a presentation of them 'in which every trace of the way in which they were reached shall have disappeared.' — (*Math. ann.*, xx. 4, 1882.) F. F. [178

PHYSICS.

Acoustics.

Sounds produced by flow of liquids. — Tito Martini has continued the researches of Savart upon the sound produced by a stream flowing through a circular hole at the lower end of a long tube containing liquid. He finds that the pitch does not change gradually, but that a definite number of distinct notes are heard successively as the liquid column shortens by the outflow. The pitch depends on the length of the liquid column and on the velocity of efflux. The number of vibrations is proportional to the velocity of efflux, and the sound is pure only when the sound of the vein is one of the proper sounds of the liquid column.

A column of constant length gives notes in a harmonic series. When the sound is re-enforced by the column of air above, it becomes quite loud. If the walls of the tube are prevented from vibrating, the sound ceases. The relative velocity of sound in different liquids may be determined by finding the lengths of the columns of liquid which give the same note, and the results given in the paper agree very well with determinations by other methods. — (*Journal physique*, Nov., 1882.) C. R. C. [179

Vibrations of loaded bar. — MM. Sébert and Hugoniot have investigated by a new method the equations of motion of elastic bars, and especially the case of a bar carrying an additional mass at one end. — (*Comptes rendus*, Oct. 30, 1882.) C. R. C. [180

Determination of rate of tuning-forks. — Michelson has devised a new stroboscopic method, in which a fork — for example, an ut_2 (No. 1) — is compared with a second ut_2 (No. 2), kept in vibration by electro-magnets, and which last fork is compared directly with the seconds pendulum. The whole number of vibrations of fork No. 2 is supposed to be known. The fractions are found as follows: one prong of the fork carries a mirror; and a few feet in front of this is placed a Geissler tube, illuminated once a second, as the circuit of the induction coil in connection with it is broken by the pendulum. The image of the tube itself in the mirror is a broad band, against which the narrow flash is projected. The number of flashes between their recurrence in two similar positions on the broad image of the tube shows the number of vibrations per second to be added to or subtracted from the known whole number. Thus, if there are a flashes in one period, $128 \pm \frac{1}{a}$ is the true rate. As fork No. 2 vibrates continuously, great accuracy can be secured. A mercury globule was used in connection with the pendulum to complete the circuit; and, by means of a relay, a break was produced in the primary circuit of the induction coil. A very constant battery must be used with the electro-magnets of the fork. The method may be simplified by dispensing with the electric fork, and placing the fork to be rated vertically, and with one edge in the focus of a microscope with cross-hairs. The Geissler tube is placed horizontally behind the fork; and the positions of the edge of the fork with reference to the cross-hairs are noted. A table of measurements is given. — (*Amer. journ. sc.*, Jan., 1883.) C. R. C. [181

Experiments with resonance boxes. — At a recent meeting of the Berlin physical society, Prof. Christiani showed a mi_3 fork, which placed on its box gave a maximum of tone when one side rather than the other was turned to the mouth of the box. The action seemed to be due to the box rather than to the fork, though this had been rusted and retuned. It was also found that a singing flame tuned to mi_3 was silenced when a mi_3 resonating box was placed horizontally with its mouth at the top of the tube, while if the corresponding fork was placed on the box no such effect occurred. The same action was noticed with a resonator; the flame being silenced if this was in tune with the flame, but not otherwise. — (*Nature*, Jan. 4, 1883.) C. R. C. [182

Optics.

Density of luminiferous ether. — Note on Glau's determination of the density of the ether, by E. Wiedmann. If an error in this estimate be corrected, the result is measurably in agreement with that of Sir W. Thomson. — (*Wied. ann.*, 1882, 986.) C. S. H. [183

Whiteness of various sources of light. — The results of a series of observations with an instrument devised by Helmholtz, and by him named 'leukoscope,' is given by A. König. The general principle upon which the instrument depends is the following: A white surface is illuminated by the light to be tested; and two adjacent images of this surface, polarized at right angles to each other, are observed through a Nicol's prism and a certain thickness of quartz cut perpendicular to the axis. With such an arrangement, the two surfaces would appear of complementary colors, the tints being determined by the azimuth of the Nicol, and the degree of saturation by the thinness of the quartz plate. With a thin plate the two portions of the field would always be very unlike; with a very thick plate, always nearly white and alike; and, finally, with a plate of intermediate thickness, the similarity would depend upon the azimuth of the Nicol. The value of the azimuth which yields the greatest similarity when a plate 20 mm. thick was employed — and this angle must evidently depend upon the color of the light used — was taken as an arbitrary measure of the whiteness of the light. The table characterizing various fa-

miliar sources of light is of interest. The angle β is the azimuth of the Nicol's prism.

SOURCE.	β
Petroleum flame	71.1°
Illuminating gas (argand = ordinary burner)	71.5
Lime light	76.7
Incandescent electric lamp (near maximum of brightness),	77.8
Arc light . . . . about	79.0
Magnesium light	86.3
Sunlight	90.5

(*Wied. ann.*, 1882, 990.) C. S. H. [184

Diffraction in telescopes. — A paper on the effect of diffraction on the appearance of a bright disk of indefinitely great radius as seen in a telescope, by H. Struve. — (*Wied. ann.*, 1882, 1008.) C. S. H. [185

Polarization of diffracted light. — The investigation here described relates to the modification which plane polarized light undergoes in diffraction by a reflecting grating of glass, of collodion, or of speculum metal. It is thus closely allied to Fröhlich's research, though of a more general character. The author, W. König, found that within the range of deviation, where elliptical polarization was marked, the determinations of azimuth were not very satisfactory: hence attention was given chiefly to difference of phase in the two components. This difference was measured by a Babinet compensator. All of the results were in satisfactory accordance with Réthy's theory of spherical polarized wave-surfaces, by which he explained the phenomena observed by Fröhlich. The experiments go far to reconcile the contradictory results, obtained by experimenters, who, following Stokes, have attempted thus to determine the relation of the plane of polarization to that of vibration; but at the same time Réthy's theory seems to end all hope of deciding this interesting point by the most promising means hitherto suggested. — (*Wied. ann.*, 1882, 1016.) C. S. H. [186

Elliptic double refraction. — E. Lommel develops his theory of refraction, to apply to the case of propagation of light-waves in a medium which rotates the plane of polarization. The equations yield a form of Biot's law for rotation involving the index of refraction, which corresponds well with observation. — (*Carl's repert.*, xviii. 673.) C. S. H. [187

Galileo's telescope. — An extended discussion of the theory of this form of telescope, by W. Pscheidl. — (*Carl's repert.*, xviii. 686.) C. S. H. [188

(*Photography.*)

Photography as applied to animal locomotion. — A simple method of studying photographically the movements of animals is described by M. G. Demeny. In front of the camera is placed a rapidly revolving disk, containing a narrow sectorial window. A white animal is selected, which moves in the sun before a very black background, best an opening in a darkened shed. The exposures with sensitive plates may be reduced to the $\frac{1}{1000}$ part of a second, the intervening intervals being sufficiently long so that the images shall not be superposed. By knowing the rate of the disk, the speed of the animal may be measured from the negative. If the plate is caused to move in the opposite direction to the image of the animal, the exposures may be made more frequently without fear of superposition, as has been done by M. Marey in his 'photographic sun' (*La Nature*, April 22, 1882). By having a number of windows in the disk, the course of small, rapidly moving objects may be studied: for example, the trajectory of a white stone thrown from the hand, or a white paper attached to the circumference of a carriage-wheel. — (*Journ. de phys.*, Nov., 1882.) W. H. P. [189

Heat.

Production of low temperatures. — After comparing the various methods for producing low temperatures, Mr. Rawbotham concludes that the method by the evaporation of ammonia is the best; ammonia being preferable to other liquids, chiefly on account of its high latent heat, and high pressure at low temperatures. — (*Journ. Frankl. inst.*, lxxxv. 2.) C. B. P. [190

Heat of solution and of dilution of perchloric acid. — In his researches on the oxyacids of chlorine, M. Berthelot has been conducted to the study of the heat of formation of perchloric acid. The solution of the liquid monohydrated acid in one hundred times its weight of water at 19° sets free +20.3 cal. This enormous heat, which exceeds that of all the common monohydrated acids, explains the extreme difference which exists between the action of this acid in solution, and the action of the monohydrated acid. It is found that the molecular specific heats of solutions of perchloric acid, between 40° and 15°, can be represented by the formula, —

$$c = 18n - 2.3 + \frac{273.8}{n} - \frac{742.2}{n^2};$$

n being greater than 6.

The heats of dilution of the acid when in different degrees of solution can be represented by a peculiar hyperbolic curve, similar to that already found for nitric acid. — (*Ann. chim. phys.*, Oct., 1882.) C. B. P. [191

Specific heat. — A modified form of Regnault's apparatus has been employed by M. W. Longuinine for the determination of specific heats. By the revolution of the cylinder the body is dropped through the floor of the chamber, in which it is heated, through a space of 0.08m. into the calorimeter. In order to obtain accurate results, it is necessary for the substance to have a spherical form. When powders and similar substances are used, they are placed in a sphere of brass, the specific heat and weight of which are known. This apparatus appears to give more uniform results than Regnault's. — (*Ann. chim. phys.*, Nov., 1882.) C. B. P. [192

Change of chemical constitution by heat. — Herr E. Wiedman has shown that a number of salts containing water undergo chemical change when heated, though the temperature is below that of fusion. He has thus found two new modifications of the sulphates of zinc and magnesium. The result has interesting bearings in the determinations of tension, and of the heat of solution. — (*Wied. ann.*, No. 12.) C. B. P. [193

Electricity.

A determination of the ohm in absolute measure. — Notice was given by A. L. Kimball of the proposed redetermination of the ohm; the method to be used being the same as that used by Prof. Rowland in 1876, changes being made in the character and arrangement of the apparatus so as to avoid, so far as possible, the repetition of constant errors. A short account was given of the nature and importance of absolute measurement in general, in which the derived units are all based on the fundamental units of length, time, and mass, and derived directly from them. The nature of the unit of electrical resistance was then noticed, and attention called to the fact, that, in the electro-magnetic system of units, the unit of resistance bears to the units of length and time the relation of a velocity. Mention was made of the most noteworthy methods that have been used in determining the value of resistance in absolute measure, attention being called to the manner in which

the units of length and time entered into the experiments. — (*Johns Hopk. univ. sc. assoc.; meeting* Jan. 3.) [194

ENGINEERING.

Automatic inspection of railways. — The precise methods of modern physical research are fast invading the various fields of practical science, and enabling us to be more and more independent of guesswork every year. Nothing illustrates this more forcibly than Mr. P. H. Dudley's dynamometer car, which is drawn from one end to the other of any railway, and, as it goes, records automatically every imperfection existing in the track, and at the end of the trip presents a long roll of paper which is a complete telltale in regard to the exact state of the road. Every bad joint, every defective rail, every lack of correct alignment, either vertical or horizontal, is shown upon the diagram in such a manner as not only to indicate the precise location of the defect, but at the same time to suggest the remedy. The dynamometer car has been employed upon a great many of our more important railroads, with the most satisfactory results. — G. L. V. [195

Railway management as a science. — Art first, and science afterwards, has been the rule in all technological pursuits, to which railways are no exception. We are fast accumulating sufficient data to show that there is such a thing as a science of railway operation; and just as soon as this fact is recognized, this science will find a place in our technical schools. The *Archiv für eisenbahnwesen*, a periodical issued by the Prussian ministry of public works, announces that there will be in the winter semester of the universities of Berlin and Breslau, courses of lectures on railroad operation, including station and train service, signalling, organization and duties of employees, and railway mechanism; and also lectures on railway administration, including the arrangement of rates and fares, the discussion of wages, and railway statistics. A third course will be on railway law, and a fourth on railway transportation as a branch of political economy. — G. L. V. [196

CHEMISTRY.

(General, physical, and inorganic.)

Magnesium carbonate. — H. Beckurts has obtained the normal magnesium carbonate $Mg\,C\,O_3.3\,H_2O$ by heating a solution of the bicarbonate to 70°. From a boiling solution the precipitate thrown down had the same composition ($5\,Mg\,C\,O_3.\,2\,Mg(OH)_2,\,7\,H_2O$) as magnesia alba prepared according to Pattinson's method. — (*Chem. tech. repert.*, xx. ii. 2, 149.) C. F. M. [197

Investigations on chlorine and bromine. — Determinations of the vapor density of chlorine and bromine when mixed with air, by C. Langer and v. Meyer, gave values corresponding to Cl_2 and Br_2. It is proposed to determine whether at high temperatures these substances, like iodine, will give a vapor density corresponding to the half molecule. — (*Berichte deutsch. chem. gesellsch.*, xv. 2769.) C. F. M. [198

Congelation of solvents. — In experiments upon the point of congelation of water, formic acid, acetic acid, benzol, nitro-benzol, and ethylen dibromide, M. Raoult tried the action of each solvent upon two hundred other substances. A solution of one grm. substance in 100 grms. of the solvent gave results from which the following law was deduced: A molecule of any substance whatever, when dissolved in 100 molecules of any liquid of a different nature, lowers the point of congelation of the liquid 0°.62, — a value nearly constant for different solvents. — (*Comptes rendus*, xcv. 1030.) C. F. M. [199

Formation of active oxygen. — Results obtained by Moritz Traube show that ozone is not produced by hydrogen in *statu nascendi*. The hypothesis of Hoppe-Seyler, that chemical processes which take place within the bodies of animals are identical with those resulting from putrefaction, and depend upon the presence of ozone produced by nascent hydrogen, must therefore be incorrect. In support of this hypothesis, Hoppe-Seyler asserted that nascent hydrogen from palladium-hydrogen would convert oxygen into its active condition. The author finds that hydrogen is not evolved from the alloy at ordinary temperatures, and that instead of ozone, in presence of water, hydrogen peroxide is formed. Other results seem to indicate that hydrogen peroxide is a product of reduction rather than of oxidation. — (*Berichte deutsch. chem. gesellsch.*, xv. 2421.) C. F. M. [200

Influence of pressure on the speed of chemical action. — Prof. R. B. Warder made the following remarks: "Menschutkin[1] has recently published his experiments on the decomposition of tertiary amylacetate by heating in sealed tubes. At 155° C., while the pressure was gradually increased by the formation of amylene, the speed of the reaction was found to increase until about half the ether was decomposed. Menschutkin's graphical representation of the progress of the reaction has a point of inflection at this stage. This fully accords with the theory of 'action of mass' if we assume that this reaction, like many others, is promoted by pressure.

If the speed of the reaction is directly proportional to the pressure, and if the increase in pressure is proportional to the amylene generated, the course of the reaction should be represented by the equation,

$$\log\frac{u_0}{m-u_0} - \log\frac{u}{m-u} = At.$$

Where u is the quantity of ether still present at any moment, to be eventually decomposed within the limit of the reaction, u_0 is the initial value of u; t is the time of action; $\frac{m-u_0}{m}$ is the ratio of initial to final pressure; and A is a constant, dependent upon the actual pressure, as well as the absolute coefficient of speed.

By making $m = 1.01u_0$, and $A = 0.04$, we obtain an equation which pretty closely agrees with Menschutkin's curve. — (*Ohio mech. inst.; sect. chem. phys.; meeting* Jan. 18.) [201

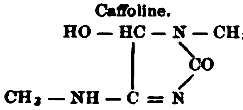
(Organic.)

Caffeine, theobromine, xanthine, and guanine. — In an extended investigation upon the constitution of these substances, Emil Fischer examined many of their derivatives and decomposition-products. Oxidation of caffeine with hydrochloric acid and potassium chlorate gave methylurea and amalic acid. This acid, without doubt, was formed directly from dimethylalloxan, in a manner analogous to the formation of alloxantine by heating alloxan with hydrochloric acid. By oxidation with nitric acid, amalic acid was converted into dimethylalloxantine, which formed cholestrophan by further oxidation. In the oxidation of theobromine, the resulting methylalloxan was immediately changed into the corresponding alloxantine, which gave methylparabanic acid by oxidation. Methylurea also was identified as a product of the oxidation of theobromine. As the decomposition-products of xanthine, alloxan was

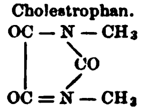
[1] Ber. chem. gesellsch. xv., 2512–2518.

recognized by conversion into alloxantine, and urea was found in the mother liquors. From bromcaffeine the amido-, ethoxy-, and hydroxy-derivatives were prepared; and from the bromine addition-product of hydroxycaffeine, diethoxyhydroxy- and dimethoxyhydroxycaffeine. When treated with hydrochloric acid, diethoxyhydroxycaffeine was converted into apocaffein, which formed caffuric acid, $C_6 H_9 N_3 O_7$, by boiling with water. By treatment with cold hydriodic acid, caffuric acid gave hydrocaffuric, from which, by decomposition with barium hydrate, methylhydantoin, methylurea, and carbonic dioxide were obtained. The formation of methyhyldantoin is regarded by the author of great importance in explaining the constitution of caffeine. This substance must contain beside the methylurea residue the carbon-nitrogen group of methylhydantoin. In the preparation of apocaffeine, the formation of another substance, hypocaffeine, was observed, which gave caffoline, $C_5 H_9 N_3 O_2$ when warmed with basic acetate of lead. Caffoline gave methylurea by reduction and by oxidation with potassium ferrocyanide, potassium permanganate, and chromic acid, respectively methyloxamic acid, dimethyloxamid, and cholestrophan. The structure of caffoline, based upon the method of its formation and its decomposition-products, would be analogous to that of cholestrophan, —

Caffoline.

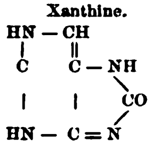


Cholestrophan.

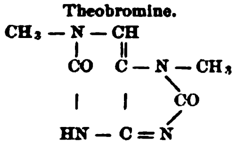


By heating xanthine-silver with methyl iodide, a methyl group was introduced with the formation of theobromine; which is, therefore, dimethylxanthine, caffeine being the trimethyl-derivative. The intimate relation existing between the plant bases caffeine and theobromine, and xanthine and guanine, which occur in animal excretions, would seem to indicate that these bodies are formed in organisms by the same chemical process. The following structure-formulae were proposed: —

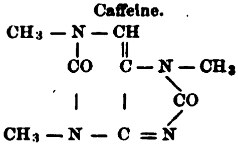
Xanthine.



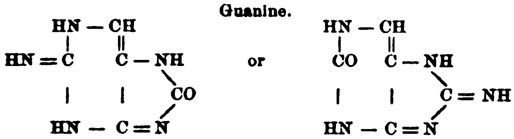
Theobromine.



Caffeine.



Guanine.



(*Ann. der. chem.*, 215, 253.) C. F. M. [202

Synthesis of uric acid. — By heating a mixture of one part glycocol with ten parts urea at 200–230°, Horbaczewski obtained a substance which proved to be identical in its composition and reactions with uric acid. — (*Berichte deutsch. chem. gesellsch.*, 15, 2678.) C. F. M. [203

Action of fomric acid on aromatic amines. — Results obtained by G. Tobias show that formic-acid derivatives of aniline, *o*- and *p*- toluidine, *α*- and *β*-naphtaline, can be obtained with greater ease than the corresponding acet-compounds. Sodium compounds of formortho- and formparatoluidine were examined. — (*Berichte deutsch. chem. gesellsch.*, 15, 2443.) C. F. M. [204

Second anhydride of mannite. — When mannite was submitted to dry distillation *in vacuo*, M. Fauconnier observed the formation of a sirupy body having the composition $C_6 H_{10} O_7$. A study of its reactions showed that it contained no carbon atoms united by more than one bond; but whether the two remaining hydroxyl groups were primary, secondary, or tertiary, remained to be determined. — (*Comptes rendus*, 95, 991.) C. F. M. [205

Some derivatives of morphine. — That morphine contains at least one phenyl-hydroxyl group, was shown by M. Grimaux, who converted it into codeine by heating it with sodium ethylate and methyliodide. Codethyline (ethyl morphine) was formed when ethyl iodide took part in this reaction; and by the use of alkyl iodides, in general, a series of derivatives was suggested. Ethylen dimorphine was obtained with ethylen iodide. When sulphuric acid, in excess, was added to a solution of morphine in glacial acetic acid with a small quantity of methyal or methylenaceto-chlorhydrine, a purple color appeared in the solution, possibly due to the formation of the base $CH_2C_{17}H_{13}NO_3$ (methylen morphine). — (*Ann. chim. phys.*, 27, 273.) C. F. M. [206

METALLURGY.

Treatment of copper ores at Spenceville, Cal. — The ore, which is fine-grained pyrites in a sort of chlorite slate, is broken into small lumps to prepare it for roasting before being hoisted to the surface. It is then dumped on a few sticks around a loose brick flue, layers of brush are put on at intervals with the ore, salt is distributed through the pile, tank residue placed on the top to exclude the air, and the heap is then fired. The period of roasting lasts six months. There are fifty leach-vats, with a capacity of 120 tons of roasted ore; the leaching is hastened by boiling with steam, and the copper is precipitated by scrap-iron. Forty-two tons of 85% copper cement are shipped monthly; eight months' supply of ore is always kept on hand. There are now 12,000 tons roasting. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [207

Bull's process for iron-smelting. — This process consists in charging the iron-ore and flux, usually limestone, without any solid fuel, gas being used instead; highly heated air is also introduced in sufficient quantity to burn about ten per cent of the gas, and to give high enough heat to melt the charge. The gases rising through the ore are carbonic oxide and hydrogen, with the nitrogen from the air. The usual zone of gasification of the iron-blast furnace is wanting, leaving only the zone of reduction, carburization, and fusion. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [208

GEOLOGY.

Surface geology of the vicinity of Baltimore. — The principal features of the Baltimore area, according to P. R. Uhler, are expressed, first, in the hard rocks of the archaean age; second, in broad beds of softer Jurassic rocks; and, third, in the superficial drift materials. The first series includes the Laurentian system, the chloritic and serpentinic series, and the overlying mica schists and quartzites. These ancient terranes are exposed in plateaus, which

have been shaped by erosion, and have a height of from 300 to 500 feet. Although, in general, similar to the archaean of other regions, yet they are especially rich in hornblendic and pyroxenic rocks; while the highly feldspathic varieties are confined to a few localities, and are usually accessible only at low levels. Baltimore lies on the eastern margin of the broad archaean belt, extending from Canada to Georgia, and having the north-north-east trend of the Atlantic seaboard. It is unbroken westward to the triassic area, and is involved in a series of well-marked folds which attained their maximum development in the Jurassic period.

In the Baltimore area no formations intervene between the archaean and the Jurassic; and the last is represented only by its highest member, the Wealden. It reaches from Elkton, in Cecil Co., to beyond Washington, D. C., with an accessible breadth of about thirty miles. It rests directly upon the archaean, and is overlaid at various points by the cretaceous, tertiary, and post-tertiary; although in the vicinity of Baltimore it is covered only by the drift deposits. The thickness of the Wealden is not less than 500 feet, consisting chiefly of sandstone with beds of clay and gravel, all derived from the archaean, and containing vegetable fossils in abundance; although only one animal has been found, the Astrodon Johnstonii Leidy, a reptile supposed to be related to the iguanodon. — (*Johns Hopk. univ. circ.*, Feb., 1883.) W. O. C. [209

Lithology.

The hornblendic granite of Quincy, Mass. — Mr. Dodge's paper is valuable as showing in a convenient form the distribution of the granite and its adjacent rocks. The only other thing new in the paper is the assumption of two different granites in the area mapped, for which he advances no evidence, although other observers have in general regarded them as local modifications of each other. The paper is, moreover, by no means an adequate representation of what is known regarding the 'Relations of the Menevian argillites and associated rocks at Braintree and vicinity;' for the author does not show the relation of the known primordial argillite to any other rock (work that had been done before by others), but only the relations of some which he has assumed to be primordial. That these argillites are all of the same age, there is good reason to doubt; for in the Boston basin certain of these are found associated with conglomerates, unconformably overlying other argillites, and holding pebbles of the latter. These two different classes of argillites differ from one another in their lithological characters; and that difference, coupled with the association with conglomerates, occurs in Mr. Dodge's so-called Menevian argillites. — (*Amer. journ. sc.*, Jan., 1883.) M. E. W. [210

Meteorites.

The Lodran meteorite. — The microscopic and general characters of this meteorite which fell at Lodran, India, Oct. 1, 1868, were quite fully described by Tschermak in 1870 (*Sitzungsb. akad. wissensch. Wien*, 1870, lxi.). Dr. Stan. Meunier finds, on studying a section, that it appears to be composed of bronzite, olivine, pyrrhotite, chromite, and grains of metallic iron. If, however, a chip is heated and then suddenly plunged into mercury, the silicates fall to pieces, while the metallic portion is seen to form a very fine network or sponge-like mass. This network is the same as, but finer than, that formed by the iron in the celebrated Pallas meteorite, to which this is allied. Dr. Meunier regards the Lodran meteorite as a true sandstone, having a metallic cement. The metallic portion was evidently posterior to the accumulation of the silicate grains, which must, before their cementation, have formed a true meteoric sand. He does not regard water action necessary to produce such a sand, but thinks, rather, that it was produced by volcanic action. — (*Comptes rendus*, xcv. 1176.) M. E. W. [211

Two Japanese meteorites. — Dr. Edward Divers describes two meteoric stones supposed to have fallen in Japan about 150 years ago. They are covered largely with the thin black fused coating common in meteorites, but in the interior are light gray in color, earthy, porous, somewhat soft, and interspersed with particles of iron and pyrohotite (troilite). The chemical analysis is as follows: —

Sp. gr., 3.62			
O.	33.18	Al.	1.00
Fe.	26.13	Na.	0.72
Si.	17.15	Mn.	0.57
Mg.	14.02	Cr.	0.28
S.	2.15	Sn. } C. }	0.15
Ni. } Co. }	1.99	P.	0.15
Ca.	1.39	K.	0.13
		Total	99.01

This is the common composition of the chondritic meteorites. — (*Trans. asiat. soc. Japan*, x. 199.) M. E. W. [212

The meteorite of Mocs. — Attention is called by Mr. E. Döll to the form and surface of this meteorite, thinking that it fell in a region that with other meteorites forms a remarkable zone of falls. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 159.) M. E. W. [213

MINERALOGY.

Mispickle. — As a result of simultaneous crystallographic and chemical investigations, A. Arzruni and C. Baerwald have shown that the prismatic angle of this mineral varies, and is accompanied by a corresponding variation in sulphur. For an increase of 0.00001 in the axis $\breve{a}$ there is an increase of 0.0236 % S, the length of the axis $\breve{a}$ in the varieties investigated varying from 0.67092 to 0.68964, and the sulphur content from 18.051 % to 22.472 %. Thus the mineral does not possess a constant composition, but varies in such a way as to have a definite effect upon the prismatic angle. — (*Zeitschr. kryst.*, vii. 337.) S. L. P. [214

Minerals from Juliane-haab, southern Greenland. — The following minerals have been described and analyzed by Joh. Lorenzen: —

Microcline feldspar.

Arfredsonite. This occurs in dark cleavable masses, hardness 5.5, G. 3.44, showing brilliant prismatic cleavage at an angle of 124° 22'; also grayish and of a more decomposed appearance. Chemical analysis of the dark cleavable variety showed that the iron was nearly all present as protoxide. The analysis agreed with the formula $11\,R\,Si\,O_3 + R_2\,O_3$, showing that the mineral holds a position among the amphiboles which contain a small quantity of sesquioxides.

Ainigmatite. A mineral resembling the above, with prismatic angle 114°, G. 3.80, is regarded as a distinct species, but no analysis is given.

Aegirine. This mineral occurs with arfredsonite, and is to be distinguished by the striations parallel to the prism; prismatic angle 86° 58', hardness 5.5–6, and G. 3.63. Chemical analysis showed that the iron exists mostly as sesquioxide, and gave the formula $Na_4\,R''\,R^{iv}{}_4\,Si_8\,O_{25}$; or, —

$$\left.\begin{array}{r} 2\,Na_2\,Si\,O_3 \\ R''\,Si\,O_3 \\ R^{iv}{}_4\,Si_5\,O_{16} \end{array}\right\}, \text{ where } \left\{\begin{array}{l} Ca : Fe = 2 : 3. \\ Al_2 : Fe_2 = 1 : 11. \end{array}\right.$$

As will be seen, the mineral is a little too basic for a bi-silicate.

Sodalite. This mineral is always colored green, arising from inclusions of arfredsonite. The crystals are dodecahedral, usually about the size of a pea; hardness 5.5–6, G. 2.31. The mineral decomposed by acids, and filtered from the undecomposed inclusions, gave upon analysis the formula $\left\{ \begin{array}{l} 2\,NaCl. \\ 3\,Na_2\,Al_2\,Si_2\,O_8. \end{array} \right.$

Nepheline. This occurs in hexagonal prisms, seldom larger than a hazel-nut, terminated by a pinacoid; also massive, accompanied by the foregoing minerals. G. of crystals, 2.60; massive, 2.63. The results of analysis gave the formula $R'_2\,Al_2\,Si_2\,O_8$; which, although once accepted, has now given place to the more complicated $R'_8\,Al_8\,Si_9\,O_{34}$.

Endialyte occurs crystallized and massive. The crystals show a great number of planes. Hardness 5.5, G. 2.85. The author has determined the oxides of the cerium metals, amounting together to 2.27 p. c. He also finds an unusually large quantity of $Na_2O = 15.90$ p. c., and 1.91 p. c. Cl. The formula deduced from the analysis varies from that of Rammelsberg, and the large percentages of Na_2O and Cl may be due to inclusions of sodalite.

Lievrite. This mineral as occurring in Greenland is described for the first time. It occurs both massive and crystalline, the crystals much striated, and terminations usually wanting. Lustre, metallic; color, black; hardness, 6; and G. 4.05. The results of analysis gave SiO_2 29.30, Fe_2O_3 20.30, FeO 33.50, MnO 1.97, CaO 13.71, H_2O 1.90 = 100.68, giving the formula, —

$$\left\{ \begin{array}{l} 2\,Fe''_2\,SiO_4 \\ Ca_2\,SiO_4 \\ Fe^{iv}_2\,SiO_5 \end{array} \right\} + H_2O;\ \text{or, } H\,Ca\,Fe''_2\,Fe^{iv}Si_2\,O_9.$$

Lepidolite. This occurs in white shining laminae, of hardness 2.5, G. 2.81. The analysis is peculiar in containing no fluorine, a very large quantity of alkalies, and only one-half the usual quantity of alumina. It does not agree closely with any definite formula.

Steenstrupine. Under this name a new mineral is described, of a brown color, hardness 4, G. 3.38. It occurs crystallized and massive. The crystals are much curved, and are referred to the hexagonal system. The composition is complicated, as will be seen from the following analysis: Ta_2O_5 0.97, SiO_2 27.95, ThO_2 7.09, Fe_2O_3 9.71, Al_2O_3 2.41, Ce_2O_3 10.66, $(LaDi)_2O_3$ 17.04, MnO 4.20, CaO 3.09, Na_2O 7.98, H_2O 7.28 = 98.38. Disregarding the Ta_2O_5, these values agree quite closely with the following formula: $Na_2\,R''\,R^{iv}_2\,(Si\,Th)_4\,O_{13},\ 3\,H_2O$. The author, however, making use of the old form of the oxides (ThO, CeO, etc.), could see no relation between the metals present, and does not attempt to deduce any formula, reserving that till more analyses are made. — (*Min. mag.*, v. 49.) S. L. P. [215

METEOROLOGY.

Popular weather prognostics. — A paper by R. Abercromby and W. Marriott has been read before the English meteorological society, which "explains over a hundred prognostics, by showing that they make their appearance in definite positions relative to the areas of high and low atmospheric pressure shown in synoptic charts. The method adopted not only explains many which have not hitherto been accounted for, but enables the failure, as well as the success, of any prognostic, to be traced by following the history of the weather of the day on a synoptic chart. The forms discussed are: cyclones, anticyclones, wedge-shaped and straight isobars. The weather in the last two is now described for the first time." The paper has not yet been published in full. — (*Nature*, Jan. 4, 1883.) W. U. [216

Observations at Geneva and Great St. Bernard. — The meteorological *résumé* for 1881 by M. Kammermann is an admirable model, worthy of imitation by those who publish similar observations. The diurnal variations in temperature and vapor tension are expressed analytically by Bessel's formula. The amplitude of barometric changes at Geneva exceeded that at St. Bernard by 1.14 mm., while the rainfall at the latter station was more than one-third greater than that at the former. It would be an improvement if the meteorological year adopted coincided with the civil year instead of beginning with December. — (*Arch. sc. phys. nat.*, Dec. 15, 1882.) W. U. [217

PHYSICAL GEOGRAPHY.

Depths of the sea. — Dr. Georg v. Boguslawski has prepared the following table of the greatest trustworthy depths found, up to 1882, in the several oceans and seas: —

	Latitude.	Longitude.	Metres.	Vessel.	Commander.	Date.
North Atlantic	19° 41′ N.	65° 7′ W.	7086	Challenger	Nares	1873
South Atlantic	19° 55′ S.	24° 50′ W.	6006	Essex	Schley	1878
North Sea	Near Neerstrand, Norway.		687	Pommerania	Hoffmann	1872
Baltic	N. W. of Gotland.		325	"	"	1871
Mediterranean	35° 6′ N.	18° 8′ E.	3968	-	-	-
Gulf of Mexico	25° 8′ N.	87° 18′ W.	3875	Blake	Sigsbee	1878
Caribbean Sea	20 miles S. of Gr. Cayman.		6270	"	Bartlett	1880
North Pacific	44° 55′ N.	152° 26′ E.	8513	Tuscarora	Belknap	1874
South Pacific	11° 51′ S.	78° 45′ W.	6160	Alaska	"	1881
China Sea	17° 54′ N.	117° 14′ E.	3840	Challenger	F. Thomson	1875
Sea of Japan	11° 24′ N.	143° 16′ E.	8367	"	"	1875
Sulu Sea	8° 32′ N.	121° 55′ E.	4663	"	Nares	1874
Celebes Sea	5° 42′ N.	123° 34′ E.	4755	"	"	1874
Banda Sea	5° 24′ S.	130° 37′ E.	5120	"	"	1874
Coral Sea	16° 47′ S.	166° 20′ E.	4850	"	"	1874
Indian Ocean	16° 11′ S.	117° 32′ E.	5523	Gazelle	v. Schleinitz	1875
Southern Ocean	62° 26′ S.	95° 44′ E.	3612	Challenger	Nares	1874
	65° 42′ S.	79° 49′ E.	3060	"	"	1874
Arctic Ocean	78° 5′ N.	7° 30′ W.	4846	Sofia	v. Otter	1868

(*Verh. ges. erdk. Berlin*, 1882, 424.) W. M. D. [218

Playas and playa-lakes. — I. C. Russell, of the U. S. geological survey, describes the abandoned shore-lines and shallow wet-weather lakes of the Utah desert region. The deposits formed in the old lakes are of two kinds: first, those formed in broad, open basins, — soft, fine, greenish saline clays, tenacious when wet, and commonly saturated with alkaline water a few feet below the surface: second,

deposits of small basins without outlet,—fine, loose, light-yellow silt, white when dry. In both of these, the coarser beds wedge out away from their source. The old Playa beds, indicating a time of desiccation, may be covered with true lake-beds, showing a more moist climate.—(*Pop. sc. monthly*, Jan., 1883.) W. M. D. [219

GEOGRAPHY.

(*Arctic.*)

Nelson's explorations in the Yukon delta.—The long residence of Mr. E. W. Nelson at St. Michaels, Norton Sound, Alaska, and the large collections obtained there by him for the National museum, are matters generally known, not only to those immediately interested, but also to the general public. His report has been anticipated with much interest. Unfortunately a too enthusiastic application to study, on his return, acting on a constitution perhaps somewhat weakened by past hardships, produced symptoms which rendered a change of scene and climate imperative as a preventive of worse evils. Mr. Nelson is now recuperating in Colorado, and is still working on his report, which will appear among the professional papers of the signal-corps of the U. S. army, but will be somewhat delayed. During his service as signal-corps observer at St. Michaels, he took part in several long sledge expeditions over little-known parts of the Yukon delta, and was able to gather a large amount of information on the geography of an area in regard to which no authentic data are on record. This information is, of course, of an approximate nature only; but, such as it is, it forms an important and valuable addition to our knowledge. Most of Mr. Nelson's notes were placed in the hands of the authorities of the U. S. census, and form the larger proportion of the new information contained in the map of Alaska lately issued by that office. Pending the publication of his complete report, he has prepared a brief account of the most important of his expeditions made in December and January, 1878–79, which has just appeared in the proceedings of the Royal geographical society of London (November number), together with a map embodying his additions to the geography of the Yukon delta. The journey in question extended from St. Michaels along the coast to the trading-post of Andreievski, at the northernmost mouth of the Yukon, thence by the Kusilvak mountain, across the delta to the vicinity of Cape Rumiantzoff, then near the coast and parallel with it to Cape Vancouver, and around to the mouth of the Kuskokvim River, the western bank of which was traversed some fifty miles northward; then the party struck across the portage to the southern bend of the Yukon, which was descended to Andreievski, after which the original route was followed to St. Michaels. Among the more important features developed were the form of the coast about Cape Rumiantzoff; the number and approximate position of the streams and inlets entering the coast between that point and the mouth of the Kuskokvim; the insulation of Cape Vancouver, which forms part of a large island separated by the large, newly named Baird Inlet, and two broad but probably shallow channels from the mainland; and the approximate location of numerous inland lakes, streams, and villages of natives. Numerous ethnological details appear in the narrative. The island off Cape Vancouver has appropriately been named Nelson Island, and a bay north of it Hazen Bay, after the present enlightened head of the signal-corps, who has done so much to promote research and exploration in these northern regions. W. H. D. [220

(*North America.*)

March of the centre of our population.—This question is discussed by L. Simonin on the basis of our census-reports; of which he says, "Four or five years are given to discussing the data, formulating the results, and illustrating them with splendid maps, making a number of magnificent folio volumes, which are distributed very generously." After describing the exceptionally rapid growth of population, and the westward advance of its centre at the rate of fifty miles a decade from the Chesapeake in 1790 to Cincinnati in 1880, he asks, "When will the centre of population agree with the centre of surface, and what will the population be then?" The answer is: in 320 years, or in 2200 A.D., this change will be accomplished, with a total of 1,600,000,000 souls,—more than the present estimated population of the world. There is, of course, much chance of error in the calculation. It was objected, that Africa might some day turn away the tide of emigration from the United States; but M. Simonin thinks it will not be Africa's turn till America is filled, and that it will never offer the opportunities found here. It was further objected, that Chinese immigration might vitiate the calculations. M. Simonin answers, that this source of increase has been but small, and is now stopped by law. Emigration from the United States is not considered sufficiently probable to affect the result.—(*Bull. soc. géogr. Paris*, 1882, 557.) W. M. D. [221

(*Europe.*)

Finland.—Max Buch prefixes an historical account of the political condition of Finland, with a brief description of the country. On the north-west, where highest, two peaks rise to about 2,000 feet altitude; thence to the south-east the country descends, the heights generally wooded, and the valleys well cultivated. The numerous lakes are mostly narrow, and are dotted over with countless little wooded islands. Of these, Lake Saima serves as a type, extending from latitude 61° to 64°, and yet often no wider than an ordinary river. Besides these larger lakes, there are countless smaller ponds, often separated only by narrow necks of land. The streams are rapid, with numerous falls; those of the Imatra, the outlet of Lake Saima, being renowned. The shore-line is deeply indented, giving many harbors, which are further protected by a fringe of plentiful islands. The climate is relatively mild, the average temperature of Abo, on the southern coast, being 4.6° C., and that of the northern coast −2.6° C. In climate and vegetation Finland differs less from Italy than from southern Greenland, though in the latitude of the last-named country. The population is about 2,060,000, with 40,000 more women than men.—(*Ausland*, 1882, 910.) W. M. D. [222

Hungarian census.—Tables and charts prepared by Ignaz Hátsek from the census of 1880 show a total population, under the Hungarian crown, of 15,642,000, with 236,000 fewer males than females (1,000 to 1,031); a total area of 324,000 □ kilometres; and an average of 48 inhabitants to the □ kilometre,—an average increase of 1.4 per cent since 1870. One-half the population belong to the Roman-catholic church; next come the Greek oriental, the reformed, the Greek catholic, and the Augsburg evangelical. Hungarian is spoken by four-tenths of the population, Croato-Servian and Rumanian by one-seventh each, German and Slovak by one-eighth.—(*Peterm. mittheil.*, 1882, 447.) W. M. D. [223

(*Asia.*)

Russians and English in western Asia.—The reading of an account of Lessar's second journey in

the Turkoman country, before the Royal geographical society last November, was the occasion of an interesting discussion on the old question of the meeting of Russian and English forces in western Asia. Sir H. Rawlinson gave high praise to Lessar's work as novel and accurate. The 'great mountain chain' which the optimists contended would protect India turns out to be a "paltry line of sandstone hills, not 1,000 feet in height, which could be crossed by a carriage-road in a couple of hours, and which would crumble before the touch of a Russian railway-engineer." He thought the present desert into which the Tedjend and Murgab flow was formerly a lake, known to the ancients as the *Aria Palus*, from which there was water-way to the Caspian. An important aid in the disappearance of the lake was probably the diversion of a branch of the Oxus from it into the Aral. He admitted that recent Russian conquest had done much in stopping robbery and suppressing the slave-trade, but thought that Afghanistan was 'beyond the scope of her influence and action,' and hoped that Lessar's project of a railway from Askabad to Herat might not be realized. Sir Bartle Frere thought the sooner the English railway-engineers pressed forward from India to meet the Russians, the farther off would be the day when the military engineers would meet. Sir H. Norman and Sir R. Temple thought the meeting would not come in their time, and that construction of railways across Afghanistan by either outside power would be difficult, and would be prevented by international agreements. — (*Proc. roy. geogr. soc.*, 1883, 12.) W. M. D. [224

(*Africa.*)

Stanley and Brazza on the Kongo. — The dispute between these explorers concerning the possession of certain trading-posts on the Kongo illustrates the activity of modern African exploration, and its commercial inportance. Brazza made a treaty in 1880, with the people on the west bank of the Kongo about Stanley Pool; whose chief, Makoko, put himself under French protection, and ceded a strip of land on the west shore of the Pool for the establishment of a trading-post, named Brazzaville. The explorer concludes that a railroad must be built to this station, and, after very insufficient examination of the route, decides that it should leave the coast near Loango, and extend almost directly eastward up the Kuilu and its branch the Niari, and over a low mountain range to the Kongo, about two hundred and fifty miles.

The expedition from which Stanley returned last year was fitted out in 1879, chiefly by the liberality of the king of Belgium, with the object of opening a free way for trade up the Kongo to inner Africa. The most difficult part of the undertaking was the building of a road from Vivi, just below the first falls of the Kongo, 230 miles up the valley to Stanley Pool, above which the river is again navigable; and after many difficulties this was completed in 1881. During this work, near the end of 1880, Stanley met Brazza coming down the valley; but the latter said nothing about his treaty with Makoko. Six months later Stanley reached the Pool, and was at first well treated by the natives; but soon such startling reports about him were spread by Malamine, whom Brazza had left there to construct the trading-station, that he was forced to retire under the protection of a friendly chief on the southern shore of the Kongo. He descended the left bank to Mandjanga, where he collected his boxes and cases, and returned to the Pool. The station-house of Leopoldville was finished there in February, 1882; and then Stanley completed his trip by a long excursion up the Kongo in a small steamboat that he had brought up over his road, reaching a point 700 miles above the river-mouth.

Stanley condemns Brazza's action in claiming the country about the Pool for France; because he was sent out by the International African association, and had no right to acquire possessions for France alone. Brazza asserts that he was provided with a hundred thousand francs from the French government, and that he had no other support. (*Ausland*, 1882, 861, 894.) W. M. D. [225

Abyssinia. — In a short *résumé* of his trip from the Red Sea to Lake Tana (Tsana) and back, by the way of Adua, G. Rohlfs makes frequent mention of the small population now in this country, in spite of its being well enough watered, supporting a sufficient plant-growth, and not appearing unhealthy: it seems to result from the frequent wars that have latterly been fought with the Egyptians. Rohlfs criticises the map about Adua by Schimper, published in the Zeitschrift der gesellsch. f. erdkunde (Berlin), vol. iv., as absolutely valueless. The article is accompanied by a valuable map, prepared by Hassenstein, of the Abyssinian plateau, showing the routes of its various explorers. — (*Peterm. mitth.*, 1882, 401.) W. M. D. [226

(*Pacific Ocean.*)

Tahiti. — R. Beltrán y Rózpide begins a description of this group of islands, with an account of their discovery and synonymy, and a brief description of the several islands. Tahiti, the largest, has an area 1,042 sq. kil., with peaks rising to 2,236 met. (*Orohena*), 2,104 (*Pitohiti*), and 2,064 (*Aorai*). Although of volcanic rock, none of the summits have crater form. In a deep valley lies Lake Uaihiria, at an elevation of 431 met., without visible outlet: it is considered either a landslip or a crater lake. Around the shore of the island is a fertile and well-cultivated plain, for which the following data are the chief climatic factors, based mostly on observations by Harcouet at Papeite in 1878. The mean temperature is 26° C.; the daily variation is about three degrees, and the annual about twelve, ranging from an average of 19° and a minimum of 15° in June, July, and August, to an average of 31° or 32° from December to March. The sea-water has an almost constant temperature of 28° or 29°, the streams from the mountains vary from 20° to 23°, and in the elevated interior the thermometer sometimes falls to 8°. The barometric mean is 759.85 mm., with a maximum of 764 and a minimum of 756.9 mm. The winds are generally from the east, but sometimes come from south-east or south-west, and then bring rain. At night there is, as a rule, a cool breeze from the interior. Rain is heaviest on the south-east; but the measures were taken on the other side of the island, and showed 91 rainy days, and a fall of 1,200 mm. in the wet season from December to April, accompanied by low pressure, calms, and gusts, and 199 mm. of rain on 23 days of the dry season from April to December. The rains are much less frequent and heavy on the coast than in the interior, where they produce high floods in the steep valleys. Among the peculiarities of the island's fauna may be mentioned the climbing crab (Birgus latro), which climbs the cocoa-palms to cut off and drop the young fruit, then descends, and carries the nuts to the shore, where it breaks and eats them. Further details of the flora and fauna are given. The population of the group was estimated about 100,000 in the last century, but this was doubtless incorrect. More trustworthy counts about 1820 gave 10,000 to 15,000; in 1848, 9,967; in 1857, 7,200; in 1862, 10,147; and the last, in 1879, 10,978. — (*Bol. soc. geogr. Madrid*, xiii. 1882, 247, 387.) W. M. D. [227

BOTANY.

(Structural and physiological.)

A general method for examining vegetable tissues. — E. Fremy has contributed much to our knowledge of the cellulose group of organic substances. In a paper lately republished, he has brought together the more important reactions presented by the members of the group, and has followed this by a memoir in which M. Urbain has assisted. From both papers the following results are now summarized. The substances which form the skeleton of plants are principally pectose and its derivatives, cellulose and its isomers, vasculose, and cutose. *Pectose* acted on by alkaline carbonates is changed into pectates. These are decomposed by hydrochloric acid, which throws down gelatinous, insoluble pectic acid. *Cellulose* and its isomers agree in being readily soluble in concentrated sulphuric acid, but differ in the following points: cellulose dissolves at once in cuprammonia; paracellulose, only after the action of acids; metacellulose, not even then. *Vasculose* is not easily soluble in concentrated sulphuric acid, but, after the action of oxidizing agents, forms resinous acids separable by alkalies from associated cellulose. *Cutose*, the transparent membrane covering the aërial organs of plants, is dissolved neither by concentrated sulphuric acid nor by cuprammonia; but it dissolves rapidly without change in dilute alkaline liquids.

Following the facts above summarized, the authors give results of their analysis of different organs of plants, a few of which are herewith given: —

Root of Paulownia. — 1°. Substances soluble in water and in dilute alkalies: cork 45, soft bast 56, body of root 47. 2°. Vasculose: cork 44, soft bast 34, body of root 17. 3°. Paracellulose: cork 4, soft bast 4, body of root 30.

Stems. — Vasculose increases in amount with density of the wood. The pith contains of cellulose 37, paracellulose 38, vasculose 25 per cent. Cork contained: matters soluble in acids and alkalies 5, cutose 43, vasculose 29, cellulose and paracellulose 12 (cutose and vasculose forming together the *subérine* of Chevreul).

Leaves of ivy. — Water and substances soluble in neutral solvents 707.7, parenchyma (formed of cellulose and pectose) 240, fibres and vessels (formed of vasculose and paracellulose) 17.3, epidermis (cutose and paracellulose) 35.

Petals of Dahlia. — Water and soluble matters 961.30, parenchyma (of cellulose and pectose) 31.63, vasculose 1.20, paracellulose 2.27, cutose 3.60.

These interesting results throw considerable light on some obscure micro-chemical reactions, particularly the behavior of tissues with cuprammonia and with alkalies. With the authors' notes relative to the bearing of their results on technical chemistry, this notice cannot deal. — (*Ann. sc. nat., bot.*, 1882, 360.) G. L. G. [228

Fertilization of alpine flowers. — During a residence of several years at Grenoble, M. Musset has paid attention to the relative abundance of flowers and insects, finding all orders of insects well represented as high as 2,300 metres. Above this altitude Lepidoptera, Diptera, and certain Hymenoptera preponderate, as Dr. Müller and others have also observed. Flower-frequenting insects are found at all altitudes, in proportion to the abundance of entomophilous flowers; their visits being determined by several causes, the state of the atmosphere being one of the most important. It is stated that the waking hours of nyctitropic flowers and of insects are identical. — (*Comptes rendus*, Aug. 7.)

M. Heckel does not attach much importance to the visits of insects in the evolution of the large flowers characteristic of many alpine plants He believes, in common with Bonnier and Flahault, that the more intense solar radiation is the chief factor in causing the larger size of flowers at high altitudes. — (*Ibid.*, Dec. 4.) W. T. [229

Pollination of Rutaceae. — In a paper read before the Linnean society of New South Wales, on plants found about Sydney, Mr. Haviland discusses the protandry of Philotheca australis and Boronia pinnata. The stamens are situated at first so as to bring the anthers over the immature stigma, as in other Rutaceae; this position insuring cross-fertilization with little waste of pollen. It is suggested, that, as they thus prevent the stigma from receiving the maximum of light and heat, their position may aid in retarding its development, and thus cause the protandry. — (*Nature*, Dec. 28.) W. T. [230

Value of crossing in plants. — For a number of years Prof. W. J. Beal of the Michigan agricultural college has been carrying on the work of experimentally testing the effects of cross and close fertilization so ably begun by Mr. Darwin. Most of his experiments have related to indian corn. As was to be expected, the results of no two years' experiments correspond at all closely; but they all show a marked gain when plants raised from seed grown some distance apart are inter-crossed instead of being allowed to self-fertilize. The average of four years' experiments shows the gain to be 27%. The least gain was a trifle under 10%; the greatest, 51%. One year's experiment with wax beans showed a gain of 136%. — (*Amer. journ. sc.*, Dec.) W. T. [231

Vegetable fly-trap. — Potonié finds that the feet of small flies that alight on the leaves of the West Indian Desmodium (Pteroloma) triquetrum are caught in the curves of the fine, arched leaf-hairs, so that their most desperate efforts to escape are unavailing. The insects captured belong to the genus Chloria. House-flies, with larger feet, are not captured; while ants and plant-lice have such small feet that they can walk over the leaves with impunity. The plant appears to derive no benefit from the death of its victims, which starve to death in captivity. — (*Kosmos*, Nov.) W. T. [232

(Systematic.)

New orchid in Florida. — The tropical Epidendrum cochleatum has been discovered by W. W. Calkins, growing upon the live-oak, at Jupiter Inlet, on the Atlantic coast of Florida. — (*Coult. bot. gaz.*, Dec., 1882.) S. W. [233

Western grasses. — A list, by F. L. Scribner, of the grasses recently collected by Pringle in Arizona and California, is accompanied by critical notes and descriptions of the rarer species. — (*Torr. bot. bull.*, Oct. and Dec., 1882.) S. W. [234

American conifers. — A popular account, by Dr. George Vasey, of the distribution and characteristics of the coniferae of the United States and Canada. — (*Amer. journ. for.*, Dec., 1882, and Jan., 1883.) S. W. [235

The tonga plant. — The drug tonga is shown by N. E. Brown to be the product mainly of a climbing aroid (Epipremum mirabile, Schott), widely distributed through the East-Indian Islands to Australia and Fiji. The plant has been hitherto involved in much confusion botanically; and a full description is given, with detailed synonymy. — (*Journ. bot.*, Dec., 1882.) S. W. [236

ZOÖLOGY.

Coelenterates.

Research on the lower invertebrates, during the years 1876–79. — The many American students who have no means of access to the journals of foreign learned societies, or to the periodical literature of zoölogy, will find, in Prof. Leuckart's summary of the work done upon the coelenterates during the years 1876–79, a very valuable abstract of the literature of this subject. Even the favored few who are able to consult the original works should be thankful to Prof. Leuckart for his brief but perfectly intelligible digests. — (*Arch. naturgesch.* xlv. ii. 591.) W. K. B. [237

Development of the tentacles of Hydra. — The great variability of fresh-water hydras demands that the order of development of the tentacles should be tabulated in a great number of specimens, in order to discover the law of their appearance. Jung has thus studied nearly two hundred and fifty specimens of three species; and he concludes, that, while there is no fixed order, each species does have a typical or average mode of development, which is more or less closely followed by the majority. The law varies with the species, and the results of Jung's researches are shown in the following diagrams: —

```
Hydra grisea.     Hydra oligactis.     Hydra viridis.

     6                  3                   1
   4 | 3              6 | 5               5 | 4
  ---+---            ---+---          8 ---+--- 7
   2 | 1              2 | 1               3 | 2
     5                  4                   6

     6                  3                   4
   4 | 3              1 | 5               8 | 5
  ---+---            ---+---          1 ---+--- 1
   2 | 1              6 | 1               6 | 7
     5                  4                   3
```

The vertical line is that axis of the bud which passes through the axis of the parent, and the upper end is the one nearest the body of the parent. The upper series of diagrams shows the typical order of appearance in normal buds of the three species named. This order was followed in 46% of 156 specimens of H. grisea, in 83% of 7 specimens of H. oligactis, and in 55% of 21 specimens of H. viridis. The second line shows the order of re-appearance in specimens after cutting off the oral end of the body with the tentacles. It was followed in 69% of 48 specimens of H. grisea, in 3 specimens of H. oligactis, and in 57% of 12 specimens of H. viridis. — (*Morph. jahrb.*, viii. 339.) W. K. B. [238

Mollusks.

Trade in Californian invertebrates. — Apart from the trade in oysters, clams, and other ordinary economic mollusks, there are certain specialities peculiar to the Pacific coast which do not appear in the trade-reports of other countries. Among these are 'abalones' (Haliotis californianus and H. splendens), the Californian pearl-oyster (Meleagrina californica), and several pearly univalves (Trochiscus Norrisii and Pachypoma gibberosum), small shells for ornamental purposes, and dried shrimps and shrimp-shells. The last are prepared by the Chinese, who catch them in large quantities, in nets of extremely fine mesh, by which very many small fish are also destroyed. The shrimps are dried on a mat over an open fire, and when thoroughly desiccated are threshed, the meats separated from the shells, and packed separately. The meats are used as food by the Chinese in all parts of the world. The shells are a particularly energetic fertilizer, superior to guano, and are packed in bundles of about 100 pounds weight for exportation to China. The various pearl-bearing shells are used for ornamental purposes, especially buttons. The export of abalones from San Francisco, by sea, in 1882, according to the annual 'market review,' was 4,638 sacks, valued at $23,455, against 4,522 sacks in 1881. They were exported to Germany (50 sacks), China (1,116 sacks), Hawaiian Islands (65 sacks), England (2,982 sacks), and New York (425 sacks), beside shipments eastward by rail. England received 563 barrels of pearl-oysters, and 49 barrels of other shells. The Chinese in South America received 99 packages of shrimp-meats, and those in the Hawaiian Islands 8 packages; while the enormous quantity of 9,611 packages of shrimps and shrimp-shells were sent to China. — W. H. D. [239

Crustaceans.

Paleozoic allies of Nebalia. — Having discussed its anatomy and development in a previous article, Prof. Packard compares Nebalia with the published figures of some of the paleozoic Ceratiocaridae, and concludes that the fossil forms should be separated from the Nebalidae as a distinct sub-order of Phyllocarida. Diagnostic characters are given for the order, and differential characters separating them from other crustacea. The memoir is to appear in full in Hayden's Twelfth report of the survey of the territories. — (*Amer. nat.*, Dec., 1882.) S. I. S. [240

New Devonian Crustacea. — J. M. Clarke describes and figures a new genus (Dipterocaris), and three new species of Ceratiocaridae from the Devonian, and remarks upon the characters of Spathiocaris and Lisgocaris, and on the wide range of S. Emersonii. — (*Amer. journ. sc.*, Feb., 1883.) [241

Shrimp and prawn fisheries. — In an article on the shrimp and prawn fisheries of the U. S., Richard Rathbun enumerates and remarks upon the edible species, makes suggestions in regard to the capture of some New-England species not now used for food, and then gives a general account of the fisheries of the Atlantic and Gulf, and the Pacific coasts. — (*Bull. U.S. fish comm.*, 1882, 139.) S. I. S. [242

Parasitic Copepoda. — R. R. Wright describes and figures in detail three species from fresh-water fishes of Canada. He seems to be unacquainted with the descriptions of allied North-American species by Kröyer, Smith, and Packard, with which his species should have been compared. — (*Proc. Canadian inst.*, n. s., i. Dec., 1882.) S. I. S. [243

Crustacean allied to Willemoesia. — C. Spence Bate describes a new genus and species (Eryoneicus caecus), taken in 1,675 fath., off the Canaries, by the 'Challenger.' It "approximates closely to Pentacheles, and adds another link between that and Eryon." — (*Ann. mag. nat. hist.*, Dec., 1882.) S. I. S. [244

Terrestrial Isopoda. — A. E. Eaton states, that Platyarthus Hoffmanseggii, which is found in ants' nests, and is reputed to be blind, is provided with eyes, and is as sensitive to light as other Oniscidae. — (*Ann. mag. nat. hist.*, Dec., 1882.) S. I. S. [245

Fauna of mountain lakes. — A. Wierzejski gives an account (in Polish) of the fauna of the lakes of the Tatra mountains, enumerating eighty species, of which forty-three are crustacea. Eight species of Cladocera and Copepoda are figured, but no new species are named. — (*Spraw. kom. fizyjogr. akad. umiej., Krakow*, xvi., 1882.)

The same author figures and describes the anatomy of Branchinecta paludosa, from the same region, and discusses its geographical distribution. — (*Rozpr. akad. umiej. wydz. matem-przyr., Krakow*, x., 1882.) S. I. S. [246

Insects.

Histology of insect wing-muscles. — The memoir of G. V. Ciaccio, to appear shortly in the Memorie dell' accademia di Bologna, may be thus summarized: In most insects the wing-muscles may be decomposed into fibrillae (in others, into striated fibres: Sphinx, Libellula, etc.). In the former case the fibrillae are united into bundles of various sizes by a cementing substance, in which the nuclei lie either both in the interior and upon the surface of the bundle (Hydrophilus, Dytiscus), or upon the surface only (flies). The bundles are held together by tracheae, and sometimes also by fat-cells. In the cement are further always found distinct particles (Aubert's *masse grumeleuse interfibrillaire*), which do not occur in the other muscles. The fibres are composed of fibrillae, and have nuclei either upon the surface (Cicada) or in the middle (Libellula). In some insects the fibrillae are arranged as in a folded lamella, the leaves of the folds running out from the centre of the fibre towards the surface, seen in cross-sections. The nerve-fibres terminate in motor plates (probably several for each fibre), consisting of a granular basal substance, in which are embedded the ramifications of the axis-cylinder. The wing-muscles are more readily dissociated into fibrillae than those of the rest of the body, from which they are further differentiated by the absence of a true sarcolemma. — (*Arch. ital. biol.*, ii. 131.) C. S. M. [247

Curious gall of a Trypeta. — Weyenbergh found in the Argentine Republic, on the terminal bud of a Heterothalamus, what resembled the froth which is secreted by the 'frog-spittle' insect, Cercopis spumaria L., but which, on touch, proved to be more substantial, or like a raspberry in texture, and on drying became tough like paper. Concealed by the froth was found a larva, which underwent its transformations within the same covert, and finally issued as a fly, which he names Trypeta (Icaria) Scudderi. The formation of the froth was observed in a larva placed on paper; it pressed its terminal segments together with nearly rhythmical movements, and so repeatedly squeezed little drops of clear fluid from the anus, which collected by and by into a frothy mass. — (*Verhandl. zool.-bot. gesellsch. Wien*, 1882, 363.) [248

(*Economic entomology.*)

Effect of pyrethrum upon Plusia brassicae. — Mr. Howard finds that the rate of pulsation of the heart of the larva is greatly increased at once, and falls but little before death. — (*Amer. nat.*, December, 1882.) J. H. C. [249

The cluster-fly. — A fly which has proved to be a great nuisance to housekeepers by entering dwellings in the fall of the year, and assembling in large numbers in beds, under table-covers, behind pictures, and elsewhere, is determined by Dr. Riley as Pollenia rudis Fabr. — (*Amer. nat.*, Jan., 1883; cf. *Psyche*, iii. 378.) J. H. C. [250

Wheat-stalk Isosoma. — Professor French observed, that in two wheat-fields which were in wheat last year ninety-three per cent of the stalks were infested by this insect; in one field which was in clover last year, not more than five per cent were infested. — (*Amer. nat.*, Jan., 1883.) J. H. C. [251

Promoting locust ravages. — It is estimated by Mr. J. P. Brown, that during the winter of 1874 one thousand car-loads of birds were destroyed and shipped to eastern markets from points west of St. Louis, Mo. — (*Psyche*, iii. 380.) J. H. C. [252

Buckeye leaf-stalk borer. — Mr. E. W. Claypole describes the habits of a new tortricid which Fernald names Steganoptycha claypoleana. — (*Psyche*, iii. 364.) J. H. C. [253

Habits of Thrips. — A species of Phloeothrips observed by Mr. Herbert Osborn in fruit-blossoms were doing much damage by injuring the styles, and thus preventing fertilization. — (*Psyche*, iii. 364.)

Although the species of Thrips are doubtless to a certain extent injurious to plants, Mr. Pergande believes that they feed chiefly upon nectar, and that they assist in fertilizing the plants they infest by carrying pollen. One species of Thrips preys upon the red spider. — (*Psyche*, iii. 381.) J. H. C. [254

VERTEBRATES.

The theory of the opening-twitch (Oeffnungszuckung). — An extended study of the opening-twitch leads Tigerstedt to the conclusion that the cause of it, and of the phenomena accompanying it in the nerve, lies in the polarization current, and, with some exceptions, in changes in the normal nerve current. The twitch due to a sudden decrease in the intensity of the polarizing current was not examined, so the above conclusion only applies to cases in which that current was completely broken. — (*Mitth. physiol. lab. Carol. inst. Stockh.*, ii. heft.) H. N. M. [255

Fish.

The development of the hypophysis in Petromyzon planeri. — Recent investigations by Prof. A. Dohrn have led to a different interpretation of the development of the hypophysis of Cyclostomes from that given by W. B. Scott or that of Balfour. The former stated in effect (*Morphol. jahrb.*, vii. 158) that the rudiment of the organ in question was unpaired. Its first appearance is marked by a slight depression above the mouth, which we may regard as the common invagination from which the nasal pit and hypophysis arise. Balfour states (*Comp. embryol.*, ii. 358), "I have observed a slight diverticulum of the stomodaeum, which I believe gives origin to it."

Dohrn holds, that his own more recent observations of the past summer show that the hypophysis arises as an independent invagination of the ectoderm between the nasal and oral invaginations. It has no connection with the latter, in that the upper lip is developed between the oral invagination and hypophysis. — (*Zoolog. anzeiger*, Nov. 6, 1882.) J. A. R. [256

Mammals.

Muscles of the raccoon's limbs. — Dr. H. Allen compares them with those of Felis domesticus. Triceps and some others undergo imperfect planal cleavage, showing imperfect differentiation; the number of nerves is variable, being most abundant in the less specialized muscles; the latter have more nerves in Felis than in Procyon; triceps and some others when normal in Procyon represent abnormalities in man; some are identical in both; others seem to be beyond the limits of variability in man. — (*Proc. acad. nat. sc. Philad.*, 1882, 115.) F. W. T. [257

Myology of Proteles. — M. Watson points out the characteristics of the muscles of Proteles cristatus, and agrees with Prof. Flower that the species should be placed in a separate family, allied to Hyaenidae and Viveridae but more closely to the former. — (*Proc. zoöl. soc. Lond.*, 1882, 579.) F. W. T. [258

Singing mice. — Herr Struck gives some notes upon a singing mouse which lived in captivity ten months. He inclines to doubt Cohen's opinion, that the musical tone is due to disease of the throat, and thinks that the mice may die in consequence of eating too rich food. — (*Arch. ver. freunde nat. Meckl.*, xxxv. 117.) — F. W. T. [259

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Rocky-mountain division. — This includes the territories of Montana, Dakota, Wyoming, New Mexico, and the state of Colorado, with headquarters at Denver. The corps consists of Messrs. S. F. Emmons, geologist in charge; Ernest Jacal and Whitman Cross, assistant geologists; and W. F. Hillebrand, chemist. This division forms part of the general subdivision of survey-work on mining-geology; i.e., its investigations are devoted more particularly to questions of direct economical importance.

The work already more or less completely accomplished by this division is as follows: —

1°. Monograph on the geology and mining industry of Leadville, which, owing to delays in the government printing-office, is not yet published, but of which an abstract appeared in the Annual report of the director for 1881. 2°. Bulletin on hypersthene andesite, now in press. 3°. Monograph on the geology and mining industry of Ten-mile district. 4°. Monograph on the basaltic mesas near Golden, Col., and their relations to the contiguous tertiary and cretaceous beds. The two latter are expected to be ready for the printer during the spring. 5°. Monograph on the geology and mining-industry of Silver Cliff. The topographic basis for this work is completed, and the geological work will be carried on during the coming summer. 6°. A study of the Denver coal-field. This work is designed to be carried on at intervals when the mountain regions are unapproachable on account of snow. The map, on a scale of one mile to the inch, covering an area of thirty square miles, was commenced in November.

As accessories a number of new and interesting minerals have been discovered in Pike's-Peak region.

Under the orders of the director, collections of typical crystalline rocks are being made, two hundred of each. The plan is, to obtain in time two hundred full suites of typical rocks which have been carefully studied both microscopically and chemically, and which will be distributed to various institutions of learning in the country to serve as a guide for students.

National museum.

Alaskan Fishes. — An important collection of forty-three species of marine fishes from south-eastern Alaska, including a new Triglops, has been recently received from Capt. H. E. Nichols. The collection is a noteworthy one, in that it furnishes proof that the range of the genus Sebastichthys extends far toward the north-west.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoölogy, Cambridge, Mass.

The 'Blake' collections. — The publication of the preliminary reports has made excellent progress during the past year. There now remain unfinished of these, only those upon the fishes, halcyonoids, foraminifera, ostracoids, nemerteans, and some minor groups, as well as the report on the bottoms. It has been decided to publish only the final reports of the fishes of the east coast and of the holothurians. That on the fishes will be published in connection with the U. S. fish-commission, and include many species of shallower waters, first brought to light by the dredgings of the 'Fish-hawk.' Prof. G. B. Goode and Dr. Bean have already prepared the greater part of this report. Dr. H. Theel of Stockholm, who has undertaken to work up the holothurians, hopes next spring to transmit his final report to the Swedish academy of Stockholm, where it is to be published. Prof. Verrill has completed the examination of the east coast Halcyonariae and Actinariae, and is preparing a report of these and of those of the Caribbean Sea and Gulf of Mexico for the museum bulletin. Work is progressing favorably on the other reports. Mr. Agassiz has nearly completed the first part of the final report on the Echini: twenty plates are already on stone, and the remaining plates are well advanced. Mr. W. H. Dall is engaged in preparing the final report on the mollusks. His preliminary reports have already been issued. Mr. P. H. Carpenter has concluded his preliminary report on the Comatulae; and it was published in October, 1881. The crinoids, which had been placed in the hands of the late Sir Wyville Thomson for determination, to be worked up in connection with the 'Challenger' material, have been transferred by Mr. John Murray, of the 'Challenger' office, to Mr. Carpenter. Mr. Carpenter proposes in connection with his father, Dr. W. B. Carpenter, to work out as fully as practicable the minute anatomy of Pentacrinus, for which the material collected by the 'Blake' is quite extensive. In addition to the Pentacrinus material, the museum specimens of Holopus were also placed in his hands. Mr. Carpenter is now preparing a preliminary report on this part of the collection. During the spring, Prof. S. I. Smith completed the report on the Crustacea, collected off the Atlantic coast of the United States during the summer of 1880. The reports already published in the museum bulletin aggregate 465 pp., and 63 pl.; and the collections have also served as the basis of several papers published elsewhere.

Peabody museum of American archaeology, Cambridge, Mass.

Indian portraits. — The museum has received the originals of sixty-eight of the plates given in McKenny and Hall's folio volumes on the 'Indian tribes of North America,' published in 1836, together with thirty-seven other portraits of Indians. These portraits are of life-size, and with few exceptions were painted by Mr. C. B. King, an artist of considerable merit. They were presented to the museum by the heirs of the late E. P. Tileston and Amos Hollingsworth of Boston, and are unquestionably of great ethnological value.

NOTES AND NEWS.

— The editor of SCIENCE will be glad to receive and acknowledge subscriptions to the Balfour memorial fund, mentioned in the leading article of this week's issue: they may also be sent to Prof. H. Newell Martin, of the Johns Hopkins university, Baltimore, who is secretary and treasurer of the American committee.

— Prof. William L. Dudley of Cincinnati has recently succeeded in obtaining a good electro-deposit of iridium, which is susceptible of high polish. The bath is kept of constant strength, by continuous solution of the metal. Thin platinum foil, coated with iridium, retains its flexibility, while the coating does not readily scale. It has been proposed to use this process to give a hard face to copper-plate engravings.

As the iridium does not rust, its advantage over steel plates is obvious. The composition of the bath has not yet been announced.

—Lewis Boss of Dudley observatory, Miles Rock of the national observatory at Washington, and Charles S. Cudlip, photographer, who were sent by the U. S. transit of Venus commission to Santiago, Chili, have just returned home by way of Panama. They had a very clear day, and obtained good observations of all four contacts, and a complete set of photographs (204). Boss observed with a 5-in. Clark refractor, power 200; Rock, with a 3-in. Clark refractor, power 200; and the photographs were taken with a horizontal photoheliograph, of 40 feet focal length, forming an image on the photograph-plate about four and one-half inches in diameter. In the contact observations the images were almost steady, the definition sharp, and no atmospheric and other phenomena like black drop, etc., were observed, but simple geometrical contacts. The narrow ribbon of twilight around Venus was very silvery, and might be mistaken by inexperienced observers for direct sunlight. This twilight ribbon entirely surrounded Venus more than three minutes before second and after third contact.

—The annual meeting of the trustees of the Peabody museum of American archaeology and ethnology, at Cambridge, was held on the 17th inst., under the chairmanship of the Hon. R. C. Winthrop. The treasurer announced that he had received $900 from subscribers in aid of American research, in addition to the $2,550 mentioned in the last annual report; and the curator was authorized to expend the same for the continuation of explorations under his direction. The curator, in presenting his report, stated that he had also received $775 for special purposes, of which $550 were for Miss Fletcher's researches among the Indians. Twenty-five free lectures were given at the museum during the past year. Numerous gifts were made to the library, and the additions to the museum had been larger than in any preceding year; the large increase being chiefly due to the special explorations made either by the curator or under his immediate direction through the liberality of patrons of American research. The great importance of systematic explorations was insisted upon; and the curator showed, by his *résumé* of what the limited expenditure had permitted, what might be done were the museum provided with sufficient means for more extended work. He also called attention to the necessity of prompt action on the part of those who were willing to aid the museum in its work if thorough and systematic explorations were to be made in our country; as every year hundreds of mounds, earth-works, and ancient burial-places were destroyed. In concluding his report, he expressed the hope that some liberal patron of science would provide for an increase of the regular income of the museum; and also for an addition to the building, since the present accommodations would not permit of the exhibition of more than two-thirds of the collections.

—'Parish botany' was the subject of a lecture which Dr. G. L. Goodale gave last Wednesday even ing before the Divinity school at Cambridge, being one of a course addressed to students of theology by officers of other departments of Harvard university. 'The boundary-line between science and religion' was the topic discussed by Prof. John Trowbridge a fortnight ago.

—On the 8th of January was held the first meeting of the Colorado scientific society, an association organized for the promotion of scientific intercourse, observation, and record, in the State of Colorado. Its officers for the first year are S. F. Emmons, president; Richard Pearce, vice-president; Whitman Cross, secretary and treasurer; Richard Pearce, Hermann Beeger, A. Eilers, and W. F. Hillebrand, standing committee. The especial attention of the members will be devoted to geology, mineralogy, and chemistry, and their application to the industrial arts. The society certainly has in Colorado a most interesting field for investigation.

—At the meeting of the Biological society of Washington, Dec. 22, Prof. C. V. Riley pointed out the real nature of the so-called 'lignified snake of Brazil,' found beneath the bark of a tree: it is, in brief, probably nothing but the excrementitious filling of the burrow of a beetle larva, one of the Buprestidae. The head of the supposed serpent is a knot, which has been manipulated to increase the deception its natural form would give; and the tapering and tortuous form of the burrow would be impossible in a snake. Mr. Riley invites the owner to submit his specimen to a crucial test — dissection. Of course the owner declined: his idol would then have perished.

—Capt. Abney has lately delivered four very interesting lectures on recent advances in photography, before the London society of arts. The text is given in full in the last few numbers of the British journal of photography; but an excellent *résumé* may be found in the Popular science monthly for January, 1883.

—The first part of Vogt and Specht's Natural history of mammals has appeared (Munich: F. Bruckmann), with many well-executed drawings by the last-named author. The work is popular in tone.

—The British admiralty surveys in 1881, mostly in Asiatic waters, are summarized in the Nautical magazine (November, 1882, 819–828).

—A representative of the Newfoundland fisheries commission recently visited Washington for the purpose of studying the methods of propagating codfish employed by the U. S. fish-commission, with a view of putting them into practice in Newfoundland.

—A pharmaceutical journal in the German language has just been started in New York by Dr. F. Hoffmann, analyst to the State board of health. It is to be published monthly; and the January number, which has just reached us, contains original papers on Rhus cotinoïdes, by Prof. K. Mohr; on The position of pharmacy in regard to mysterious remedies in North America, by Prof. Dr. Maisch; a Report of the changes of the state of the pharmacopeia, by Dr. A. Tscheppe, besides two unsigned articles. Eight pages are given up to a monthly classified *rundschau* of pharmacy, excellently done.

—Dr. S. M. Burnett spoke at the meeting of the Washington philosophical society, Jan. 13, on Refraction in the principal meridian of a triaxial ellipsoid; regular astigmatism and cylindrical lenses; and was followed by Prof. William Harkness on the Monochromatic aberration of the human eye in aphakia. Jan. 27, Mr. H. H. Bates read a paper on the Nature of matter.

—At a meeting of the section of mechanics and engineering of the Ohio mechanics' institute, Jan. 23, papers were presented on Governors and fly-wheels, by Mr. James B. Stanwood; The wastage of water, by Mr. Thomas J. Bell; Saving of fuel, and smoke-prevention, by Mr. J. P. Kilbreth. A report on Pumping-engines for public water-supply was presented by John W. Hill, M.E.; and Prof. R. B. Warder made some remarks on The duty of steam-engines.

—At the Philosophical society of Washington, Feb. 10, Dr. A. F. A. King read a paper on the 'Prevention of malarial diseases, illustrating, *inter alia*, the conservative function of ague.' Mr. E. J. Farquhar and Dr. J. S. Billings took exception to the theories advanced. Capt. C. E. Dutton exhibited a series of oil-paintings illustrative of the volcanic phenomena of the Hawaiian islands.

—At the meeting of the American academy of arts and sciences, Feb. 14, the following papers were presented: Quantitative researches in photography, by Mr. W. H. Pickering; Photography as a means of determining the light and color of the stars, by Messrs. E. C. and W. H. Pickering; The historical hydrography of the west coast of North America, by Mr. J. Winsor.

—At the meeting of the Biological society of Washington, Feb. 16, Dr. Coues' paper on zoölogical nomenclature applied to histology was discussed, and papers were read on Biology and classification, by Mr. Newton P. Scudder; On the structures of protoplasm and karyokinesis, by Mr. John S. Ryder; The human fauna of the District of Columbia, by Prof. Otis T. Mason; Section cutting and mounting of hard woods, with illustrations, by Dr. Thomas Taylor.

—A lecture on the development of civilization was delivered in the U.S. national museum by Prof. E. A. Fay of the National deaf-mute institute, on Jan. 26, before the students of the latter institution. The gesture-language was delivered with remarkable ease and grace. The audience was very attentive throughout the lecture, and showed its appreciation of the points made by the speaker, by nods and movements of the fingers.

— We learn from the daily papers, that a proposition to abolish the geographical survey of New Jersey is meeting with favor on the part of some would-be economists in the legislature of that state. Apart entirely from its scientific worth, it would be hard to point out a state in the Union where the quiet inexpensive work of the state geologist has been so fruitful in economical value as here.

— A course of ten lectures on zoölogy is being given by Prof. A. S. Bickmore in the American museum of natural history, Central Park, New York, on Saturday mornings. The lectures commenced on Jan. 20, and are almost wholly upon the higher vertebrates, those in March being upon monkeys and the different races of men. We understand the course is very well attended; but the small lecture-room is a disgrace to such an institution if it contemplated such courses at the outset.

— In recognition of their scientific services at the international geological congress held last year at Bologna, the Italian government has created Prof. James Hall of Albany a Commander of the ancient order of Sts. Mauritius and Lazarus, and given Dr. T. Sterry Hunt of Montreal the rank and decoration of Officer of the same order.

— The first half of the second course of scientific lectures delivered in the National museum, under the auspices of the biological and anthropological societies of Washington, now completed, has met with the most remarkable and flattering success. The audiences increased in size from the first; the number of persons attending lectures far exceeding the seating-capacity of the hall, and in one instance exceeding two thousand. The first lecture by Capt. Clarence E. Dutton, on Rivers, although brief and not illustrated, contained a clear, and in many respects original, exposition of the *rôle* of rivers in the great drama of the globe. Prof. Otis T. Mason, who delivered the second lecture on the 20th ult., took for his topic The races of men, and gave a brief but succinct summary of the present condition of knowledge in this branch of anthropology. The lecture was illustrated by busts and casts of different races of men, from the museum collection, and by diagrams. Mr. George Kennan, who was third in the course, delivered an eloquent lecture on the Mountains and mountaineers of the Caucasus, and was listened to with closest attention during the two hours occupied in its delivery. Dr. D. W. Prentiss happily selected for his theme, Mesmerism in animals, — a topic which, although attracting much attention among French *savants*, is familiar to the

American public almost exclusively through the insufficient medium of the newspapers. Dr. Theo. Gill, who lectured on the 10th inst. on Mythical animals, departed from the consideration of animals which exist in fact, and gave his audience an account of some which exist in fancy. Dr. John S. Billings closed the first half of the course, taking for his theme, Germs and epidemics. He gave a concise account of the results of the latest investigations of Pasteur and others, regarding the relations of microscopic organisms to disease; weaving in, to a greater or less extent, his own views upon the matter.

The programme for the second half of the course is as follows: Feb. 24, Prof. L. F. Ward, the Plant life of the globe, past and present; March 3, Mr. W. H. Dall, Pearls and pearl-fisheries; March 10, Major J. W. Powell, Indian mythology; March 17, Prof. C. V. Riley, Adaptation and interdependence between plants and insects; March 24, Prof. C. A. White, the Teachings of paleontology; March 31, Dr. R. Fletcher, U. S. A., Human proportion in art and anthropometry.

RECENT BOOKS AND PAMPHLETS.

[*Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.*]

Baltimore — Johns Hopkins university. Studies in historical and political science; ed. by Herbert B. Adams. Baltimore, *University*. 1882–83. 8°.
- I. An introduction to American institutional history; by Edward A. Freeman. 1882. p. 39.
- II. The Germanic origin of New England towns; by H. B. Adams. With notes on cooperation in university work. 1882. p. 57.
- III. Local government in Illinois; by Albert Shaw: Local government in Pennsylvania; by E. R. L. Gould. Jan., 1883. p. 37.
- IV. Saxon tithing-men in America; by H. B. Adams. Feb., 1883. p. 23.

Bible myths, and their parallels in other religions; being a comparison of the old and new testament myths and miracles with those of heathen nations of antiquity, considering also their origin and meaning. N. Y., *Bouton*. 1883. 650 p. 8°.

Bouchon-Brandely. Rapport au ministre de la marine sur la génération et la fécondation artificielle des huîtres portugaises. Paris, 1882. 51 p. 8°.

Brubaker, A. P. Physiology. Philad., *Blakiston*. 1883. 133 p. 12°.

Buet, Charles. Madagascar, la reine des îles africaines: histoire, moeurs, religion, flore, etc. Paris, *Palmé*. 1883. 12+391 p. 8°.

Cambridge entomological club. Annual reports for 1882. Cambridge, *Club*. 1883. 31 p. 32°.

Connecticut agricultural experiment station. Annual report for 1882. New Haven, *State*. 1883. 114 p. 8°.

Conn. — Shell fish commissioners. Second report. Middletown, *State*. 1883. 44 p., map. 8°.

Davy, Humphry. Les derniers jours d'un philosophe. Entretiens sur la nature, les sciences, les métamorphoses de la terre et du ciel, l'humanite, l'âme, et la vie eternelle. Ouvrage traduit de l'anglais, accompagné d'une préface et de notes, par C. Flammarion. *9e éd.* Paris, *Didier*. 1882. 32+374 p. 18°.

Fabre, J. Henri. Histoire naturelle. Géologie (programme officiel du 3 août 1880 et instructions ministérielles du 18 oct. 1881). *3e ann.* Paris, *Delagrave*. 1882. 260 p. 12°.

Ferris, B. G. A new theory of the origin of species. N. Y., *Fowler and Wells*. 1883. 278 p. 12°.

Gerhard, W. Paul. House drainage and sanitary plumbing. N. Y., *Van Nostrand*. 1882. 205 p. 24°.

Girardin, J. Leçons de chimie élémentaire appliquée aux arts industriels. *6e éd.* Tom. iii. Chimie organique. Paris, *Masson*. 1883. 620 p., 330 fig. 8°.

Grand, S. L'industrie huitrière à Marennes; la Seudre et ses rivages; des claires à verdir, soins annuels à donner aux claires, etc. Paris, *Michelet*. 1883. 31 p. 8°.

Guérin, Victor. Rapports addressés à M. le ministre de l'instruction publique, sur sa mission scientifique dans le Liban. Paris, *imp. Levé*. 1883. 28 p. 8°.

Hale, P. M. The woods and timbers of North Carolina; a compilation from the botanical and geological reports of Drs. Curtis, Emmons, and Kerr; to which are added information obtained from the census bureau and accurate reports from the several counties. Raleigh, *Hale*. 1883. 272 p., map. 12°.

Indiana. — Department of geology and natural history. Eleventh annual report, 1881. John Collett, state geologist. Indianapolis, *State*. 1882. 414 p., 5 maps, 55 pl. 8°.

Kuhff, G. A. Les organes génitaux de l'homme et de la femme, structure et fonctions, etc. *2e éd.* Paris, *Baillière*. 1883. 64 p. 8°.

Latteux, Paul. Manuel de technique microscopique, ou Guide pratique pour l'étude et le maniement du microscope. *2e éd.* Paris, *Delahaye*, etc. 1883. 11+477 p., 177 fig. 18°.

Lecouteux, Edouard. Le blé, sa culture intensive et extensive. Paris, *imp. Chaix*. 1882. 8+413 p., 60 fig. 18°.

Marchand, Léon. Botanique cryptogamique pharmacomédicale; programme raisonné d'un cours professé à l'école supérieure de pharmacie de Paris. Tom. i. Paris, *Doin*. 1883. 481 p. 8°.

Milne-Edwards, Alphonse. Anatomie et physiologie animales. Paris, *Masson*. 1883. 4+406 p. 311 fig. 18°.

Mortillet, Gabriel de. Le préhistorique: antiquité de l'homme (Bibl. sciences contemp.). Paris, *Reinwald*. 1883. 642 p. 8°.

New York. — Linnaean society. Transactions. Vol. i. N.Y., *Society*. 1882. 168 p., portr. l. 8°.

Niox, *Comm.* Géographie militaire. v. Europe orientale et bassin de la Méditerranée. 1e partie: péninsule des Balkans. Paris, *Baudoin*. 1882. 8+231 p. 18°.

O'Donovan, E. The Merv oasis. Travels and adventures east of the Caspian during 1879–81, including five months' residence among the Tekkés of Merv. 2 vol. N.Y. 1883. illustr. 8°.

Pharmaceutische rundschau und zeitung für die wissenschaftlichen gewerblichen interessen der pharmacie und verwandten berufs- und geschäftszweige in den Vereinigten Staaten; herausg. von Dr. Fr. Hoffmann. Bd. i. no. i. N. Y. 1883. 26 p., *m*. 4°.

Pioger, L. M. Dieu dans ses oeuvres; les splendeurs de l'astronomie, ou Il y a d'autres mondes que le nôtre. Paris, *Haton*. 1883. 18°.
La lune. 4+315 p.
Le soleil. 8+373 p.

Poitevin, A. Traité des impressions photographiques. Suivi d'appendices relatifs aux procédés, par M. Léon Vidal. *2e éd.* Paris, *Gauthier-Villars*. 1883. 14+280 p., portr. 18°.

Proctor, R. A. The great pyramid, observatory, tomb and temple. N.Y., *Worthington*. 1883. 8+323 p. illustr. 12°.

Rawlinson, G. The religions of the ancient world, including Egypt, Assyria and Babylonia, Persia, India, Phoenicia, Etruria, Greece, Rome. N.Y., *Scribner*. 1883. 12+249 p. illustr. 12°.

Rochas, Albert de. La science des philosophes et l'art des thaumaturges dans l'antiquité. Paris, *Masson*. 1883. 220 p. 24 pl. 8°.

Selvatico, Silvestro. Sur le développement embryonnaire des bombyciens. Traduction par J. Pelletan. Paris, *Doin*. 1883. 31 p., 7 pl. 8°.

Tissandier, Gaston. Les martyrs de la science. *2e éd.* Paris, *Dreyfous*. 1883. 334 p., 34 pl. 8°.

Tyndall, J. Heat as a mode of motion. *New enl. ed.* N.Y., *Appleton*. 1883. illustr. 12°.

U.S. — Corps of engineers U.S. army. Professional papers, no. 24. Primary triangulation of the lake survey; by Lieut.-Col. C. B. Comstock, U.S.A. Wash., *Government*. 1882. 920 p. 4°.

Waldmann, F. Der bernstein im alterthum; historisch-philologische skizze. Fellin. 1883. 87 p. 4°.

Wharton, W. J. L. Hydrographical surveying; a description of the means and methods employed in constructing marine charts. London. 1882. 8°.

Yung, Emile. Le sommeil normal et le sommeil pathologique; magnetisme animal, hypnotisme, névrose histérique. (Bibl. biol. intern.) Paris, *Doin*. 1883. 196 p. 18°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

FRIDAY, MARCH 2, 1883.

THE INTERNATIONAL CONFERENCE FOR THE DETERMINATION OF THE ELECTRICAL UNITS.

At a meeting of the electrical congress, Oct. 5, 1881, it was recommended that the French government should invite the other powers to constitute an international commission to discuss the following points: —

1. To determine for practical science the conditions which a column of mercury should fulfil in order to represent the electrical unit of resistance.

2. To determine upon a definite standard of light.

3. To arrange a systematic and universal plan for studying atmospheric electricity, terrestrial magnetism, and the exchange of international observations.

In accordance with this recommendation the French government communicated with the other powers; and representatives appointed by the various governments assembled in Paris, Oct. 16, 1882, at the residence of the foreign minister. At the first meeting there were forty-seven representatives present, among whom were Helmholtz, W. Siemens, Wiedemann, Kohlrausch, Fröhlich, Lorenz, Dumas, Mascart, Tacchini, and Weber. The representatives from Great Britain and the United States had not been notified in time to attend the opening of the conference.

Upon organization, three committees were formed, — one upon electrical units, one upon earth-currents and lightning-rods, and another upon a standard of light. At first the time of the conference was largely devoted to discussions of the best methods of determining the unit of electrical resistance. Various suggestions were made in regard to the limits of accuracy, and to the necessity of repeating the observations already made at different places on the earth's surface, in order to eliminate the errors due to locality. M. Broch of Norway suggested that the calorimetric determinations of the ohm should be carefully made; this method being the most direct one, although it required a precise value of the mechanical equivalent of heat. Sir W. Thomson and Helmholtz pointed out that the heat method depended upon the measurement of current, and could only be considered as a method of control. MM. Lorenz and Roiti presented papers upon the determination of the ohm, and Wiedemann gave a bibliography of the subject. After hearing the careful and minute discussion of the subject, the following resolutions were adopted: —

1. The commission consider that the determinations made up to the present time are not sufficiently concordant to allow the value of the ohm to be fixed.

They believe that it is necessary to continue the researches upon this value. Although they do not advise observers to restrict themselves in the choice of methods, they consider the following methods particularly adapted for exact determinations: —

a. Induction of a current upon a closed circuit (Kirchoff).

b. Induction by the earth (W. Weber).

c. Decrement of moving magnets (W. Weber).

d. Apparatus of the British association.

e. Methods of M. Lorenz.

It is also desirable to determine the ohm by the quantity of heat evolved by a given current, using this method as a control method.

2. It is thought desirable that the French government should take the necessary steps to prepare certain standards of resistance, which can be placed at the disposal of scientific men, in order to compare their values.

The commission was, at first, of the opinion, that when the results of the different observers reach an approximation of $\frac{1}{1000}$ of the true value, the value of the practical unit of resistance should then be fixed. After much discussion, it was felt that no decision upon the limit of accuracy could be reached at present. Mascart then described the methods adopted for the study of atmospheric electricity. Sir W. Thomson showed that it was important to make observations upon the air in a definite enclosure, or, in other words, upon the air itself. Helmholtz in this connection remarked,

that one of his students had shown that the electrification of the air in the interior of a laboratory could be readily perceived. Thomson then gave a short description of the kind of room and the disposition of its walls which would be desirable in an observatory for such researches. The commission concluded to recommend to the various governments regular observations on atmospheric electricity.

An interesting discussion upon lightning-rods then followed. Helmholtz said, that statistics in regard to strokes of lightning and in regard to the effect of various kinds of lightning-rods were about to be collected in the province of Schleswig-Holstein, the position of this province between two seas being particularly advantageous. It already had appeared that the country is more exposed to strokes of lightning than the cities, and that in villages the public buildings were more frequently struck than the houses. He also remarked, that the academy of Berlin had recommended the employment on telephone-lines, where they enter houses, of a lightning-protector, consisting of two little spheres very near each other, one of which is connected to the line, and the other to the earth. M. Ludewig of Germany gave some statistics in regard to damage to telegraphic and telephonic apparatus in Germany during the period from April 1, 1881, to Aug. 20, 1881. During this time there had been 2,301 storms; and these had produced 2,165 cases of damage, more or less serious.

It was debated whether a set of questions in regard to the perturbing effect of storms upon telegraphic apparatus should be issued. After much discussion, a sub-committee was formed to formulate a set of questions. Among the members of this committee were Helmholtz and Mascart. The question of the observation of earth-currents was then taken up. It was regretted that the existing telegraph-lines running north and south, and east and west, could not be utilized for the observation of earth-currents. The pressure of business usually prevented this. M. Blavier pointed out, that the earth-currents are generally too feeble to be observed on telegraph-lines which are in operation. Moreover, the polarization of the earth-plates of the battery would cause trouble. Mascart, in reply, said that he had noticed that the maximum disturbance was reached slowly, through a period of several days, and died out also slowly. He therefore thought that existing telegraphic lines could be used, notwithstanding the objections of M. Blavier. He proposed that observations should be made upon lines reserved for the purpose, and also on existing telegraphic systems. A question arose upon the length that these lines should have. Helmholtz remarked, that one could make observations on lines from one to two kilometres in length. It would be necessary, however, to shun the effects of polarization of the electrodes. He thought that special plates surrounded by peroxide of manganese might be serviceable.

The commission in general were in accord on the necessity of organizing a systematic study of earth-currents upon telegraphic lines, or at least records of these currents on the days specified for observations by the international polar expeditions (the first and fifteenth of each month, from September, 1882, to September, 1883). In a general discussion which followed, upon lightning-conductors and electrical storms, Helmholtz expressed his doubt about the efficacy of extent of contact of lightning-conductors with the earth, and the varied nature of the plates employed. M. Van der Mensbrugghe (Belgium) spoke of the desirability of studying the nature of lightning discharges, especially that termed ball-lightning. Mascart replied, that he did not believe that cases of ball or globular lightning were well substantiated. It might happen that it was an illusion of the senses, and could therefore be relegated to physiology rather than to physics. The commission then discussed the question of studying the best conditions for the establishment of an international telemeteorographic system, which would permit various stations in different countries to communicate continuously with each other. They decided that it did not appear that the time had come for the establishment of such a system; but they ex-

pressed the opinion that such a system would be highly desirable.

Then followed a long discussion upon the standard of light. It was generally granted that a white light was desirable. Wiedemann remarked, that a fine gauze saturated with the spirit of turpentine, burning in oxygen, gave a very white light. Siemens proposed to employ a current of oxygen passing through a carburetted hydrogen, maintained at some fixed temperature. One could thus obtain a constant mixture which would burn with a white flame. Helmholtz thought that it would be extremely difficult to produce a mixture of air and carburetted hydrogen in constant proportion, and to regulate the temperature. Dumas thought that the late experiments of Violle upon the light emitted by melting platinum might solve the problem. The point of fusion of a body seemed to him to be as good a fixed point as could be wished. He invited the commission to view the experiments of Violle.

After witnessing the experiments of Violle, the members of the commission appeared to think more favorably of Dumas' suggestion. Professor Leblanc, who has had charge for many years of the photometric determinations of the lighting-gas of Paris, was invited to explain his methods; and the members of the commission, in turn, were invited to witness the methods in his laboratory. Professor Leblanc stated his preferences for the employment of a Carcel lamp for photometric determinations. He showed that the personal equation could be practically eliminated, and that differences of tint did not influence the results to the degree supposed. Sir W. Thomson spoke of the advantages of Rumford's photometer. The following resolutions upon this subject were finally adopted: —

a. The conference express their hope that the experiments now in process upon the light emitted by melting platinum will lead to a definite standard of light.

b. They recommend the employment of the Carcel lamp as a secondary standard, this lamp to be employed with the precautions adopted by MM. Dumas and Regnault.

Candles can also be employed as a secondary standard, if sufficient care be taken in regard to their construction and constitution.

c. They call attention also to the necessity of the analysis of the different conditions under which comparisons of light are made, and reiterate the opinions, expressed at the meeting of the electrical congress of 1881, in regard to the necessity of taking into account the amount of light radiated from sources of light in different directions.

At the close of the conference, Sir W. Thomson expressed the opinion that the labors of the conference would stimulate researches during the coming year; and he congratulated the conference upon its important work.

On the 26th of October, President Grévy received the members of the commission at the Palais d'Elysées; and, after a reception by Minister Cochéry, on the afternoon of the same day, the conference was adjourned to the first Monday of October, 1883.

ON THE PHYSICAL CONDITIONS UNDER WHICH COAL WAS FORMED.[1]

THE mode of formation of coal has been much discussed, and various theories have been promulgated in regard to it; but the peat-bog theory, as it is called, has been generally accepted. This is the view, that coal is the residual hydrocarbon of plants which have grown where their remains are found, and that it has been formed precisely as peat accumulates in marshes at the present day.

So great has been the harmony of opinion on this subject, that it would at first sight appear unnecessary to renew discussion on a question that had seemed to be definitely and permanently settled. The calm of geological opinion which has prevailed on the coal-question has, however, been recently disturbed by a very voluminous and painstaking discussion of the mode of formation of coal, by M. Grand'Eury, which occupies nearly 300 pages in the *Annales des mines* for the present year. In this discussion the theory is advocated, that the carbonaceous matter forming beds of coal has been derived from plants, but plants transported from their places of growth, and deposited at a greater or less distance in the bottom of water basins.

[1] Read before the National academy of sciences at its semi-annual meeting in New York, Nov. 14-17, 1882.

We have reports, also, from time to time, of a system of experiments and observations made by M. Fayol, at Commentry, in the department D'Alliers, in Central France, from which he draws the same inference; and it is apparent that a formidable attack has been made all along the line upon the peat-bog theory.

For this reason, and in order that geological truth shall be maintained, I venture to report some facts which I have myself observed in the coal-fields of the Mississippi valley, and which in my judgment are incompatible with the conclusions of MM. Grand'Eury and Fayol.

The opinions presented in the discussions of the chemical and physical history of coal have been based upon two classes of facts: viz., 1°, those gathered from the study *in the field* of the structure and relations of the coal-beds; and, 2°, those obtained from chemical and physical experiments conducted *in the laboratory*. Now, while there is no doubt that such experiments have contributed much to our understanding of the subject, it is obvious that they have misled observers, through the impossibility of imitating by artificial means the grand processes of nature. She has in most instances left a full and faithful record of her work; but the same difficulties attend the disinterment and translation of this buried record that have been encountered by the students of archeology in their efforts to trace the early history of mankind. Necessarily this is a work of time; and much study is required for the acquisition of a full and accurate knowledge of the language in which it is written, and for the gradual accumulation of the large amount of material required. Yet I claim, that so much of nature's record of the processes pursued in the formation of coal has been submitted to our observation, and that this record is so clear that the truth is within our reach; and, further, that this truth is discordant with the results obtained in artificial experimentation, and therefore proves such results fallacious.

In the present communication, nothing like a full discussion of the arguments *pro* and *con* will be attempted; since the space at my command will permit me to cite only a few of many facts, and to very briefly read their meaning.

For the present I will confine myself to some of the phenomena presented by one of the Ohio coal-beds with which I am specially familiar. This is our 'Coal No. 1,' the lowest of the series, sometimes called the Brier-Hill coal. As this has furnished a fuel of exceptional purity, such as could be used in the raw state for the smelting of iron, and lies nearer to the navigable waters of Lake Erie than any other, it has been very extensively worked. The result of this working has been to show, that the coal is confined to a small part of the area it was once supposed to cover, and that it lies in a series of narrow troughs, or basins, which were evidently once peat-marshes, occupying local depressions in the then existing surface. A large number of these detached coal-deposits have been now completely worked out, and the phenomena they present fully exposed to view. Among these phenomena I may cite: —

1. Below the coal a fire-clay, penetrated in every direction with roots and rootlets of Lepidodendron, Sigillaria, etc.

2. A coal-seam having a maximum thickness of six feet in the bottom of the basins, thinning out to feather-edges on the sides, and containing only two to three per cent of ash.

3. The coal on the margins of a basin rising sometimes thirty or forty feet above its place on the bottom.

4. A roof composed of argillaceous shale, of which the lower layers, a few inches in thickness, are crowded with the impressions of plants; among which are interlocked prostrate trunks of Lepidodendra and Sigillaria, traceable from root to summit, often carrying foliage and fruit, the fronds of ferns, — sometimes ten or fifteen feet in length, complete and smoothly spread, — Calamites, Cordaites, etc.

5. In many places the roof marked with circles one to two feet in diameter, called by the miners 'pot-bottoms.' These are sections of the bases of the upright trunks of Sigillaria or Lepidodendron, which rise *perpendicularly*, sometimes many feet, into the overlying shales. They consist of hollow cylinders of coal, perhaps a half-inch in thickness, the interiors of which are filled in with shale, laminated horizontally, and sometimes contain remains of plants and animals which must have been introduced when they were hollow stumps standing where they grew.

6. In certain circumscribed areas, part of the coal-seam is cannel, bituminous shale, or black-band iron-ore; and, as in all cases of this kind, the cannel, shale, and black-band contain the remains of aquatic animals, — crustacea, fishes, or mollusks, — the normal or cubical coal never including any thing of the kind.

7. The boundaries and bottoms of the chan-

nels and basins which hold the coal, composed of the Waverley shales, or the carboniferous conglomerate.

From these facts I translate the following history, which I am sure will be accepted as true by every geologist who has had sufficient experience in field-work to make his judgment of such phenomena trustworthy.

I. At the beginning of the formation of the coal-measures, north-eastern Ohio was a land surface, underlain by the Waverley shales, or beds of gravel, now the conglomerate. This surface was furrowed by the valleys of streams, and pitted by local basins, similar to those which mark the present surface.

II. With a slow subsidence, which continued with interruptions throughout the coal-measure epoch, the drainage was checked, and lakes and marshes were formed in the depressions of the surface. In these basins a fine sediment was deposited, — the 'fire-clay,' — like the clay now found under some of our peat-beds. When overgrown with vegetation the roots of plants penetrating this silt drew out of it iron, potash, soda, etc., leaving it nearly pure silicate of alumina, and specially refractory; whence its uses and name.

III. The marshes and lakes were ultimately filled with peat, which rose to a general level near the water-line, and was sometimes thirty or forty feet deep in the deepest parts of the basins.

IV. In places, water-basins remained such through a considerable portion of the time occupied in the accumulation of the peat; and sluggish streams flowed through the marshes, connecting these basins, and transporting to them fine sand, clay, lime, iron, etc., which, mingling with the completely macerated vegetable tissue, formed cannel coal, black-band iron-ore, and bituminous shale. After a time these basins also were filled with peat growing from the margins, just as our lakelets are now filled, and converted into peat-marshes.

V. After ages had passed with the physical conditions described, a subsidence caused a submergence of the peat-marshes, which first resulted in the destruction of the generation of growing plants that covered them. These dropped, in succession, leaves, twigs, and branches; and, finally, most of the standing trees fell. Some, however, continued longer to maintain an upright position, while the fine argillaceous sediment suspended in the water was slowly deposited around them, to form the roof shale, — of which the lower layers are charged with the *débris* of the plants growing on the marsh; the upper layers, deposited when these were all buried, nearly barren of fossils.

VI. The weight of the superincumbent mass pressed down the bed of peat; which, consolidated by that process, and undergoing internal chemical changes, ultimately became a bed of coal, thickest in the deepest part of each basin, thinning and rising on each side up to its edge, which remains to mark the original level of the surface of the peat-marsh.

Thus, and in no other conceivable way, was the resulting coal-bed made six feet thick in the bottom of the basin, and running out to nothing on the sides, thirty or forty feet higher.

The whole anatomy of the coal-seam shows that it was formed where it is found; the erect trees and plant-bearing shale above, the root-penetrated fire-clay below, the small amount of ash (only the inorganic matter of the plants), with many other features it presents, making the theory that it has been transported untenable. J. S. NEWBERRY.

THE YALE OBSERVATORY HELIOMETER.

FOR the benefit of the non-astronomical reader whose heliometric ideas are vague, the instrument may be defined as a measuring-machine in which the images of two stars, or other celestial objects to be measured, are superposed in the telescopic field by the following method: a telescope object-glass is cut across one of its diameters, and the two halves thus formed can be moved in opposite directions along the line of section by the observer while looking through the eye-piece. If he were examining the sun, for instance, with the two halves of the object-glass together, then he would have an ordinary telescopic view of the sun; but let him separate them, and he has the effect produced in the sextant when the two sun's images are separated by moving the arm. Now, if he brings the two images tangent first on one side and then on the opposite side by passing one over the other, the distance the object-glass halves are moved can evidently be expressed in arc, when the focal length is known, and is a measure of the sun's angular diameter. The advantages of such a method of measurement are only to be fully appreciated from certain considerations in physiological optics, from which it seems to be established that the most accurate measurements by direct vision are to be expected when the measuring-scale and the object measured are precisely similar in appearance and

can be symmetrically placed. In the case given, the sun's limbs are of the same color and form, and the two positions are symmetrical with reference to each other. In measuring stars, the apparent magnitudes being made approximately equal, their images may be made to pass over each other with the greatest nicety; and in both these cases the observer's eye is steadily directed to a definite point in the telescopic field. In practice this seems to give more precise results than when the observer's attention is directed to two points at some distance from each other, and both bisected by the webs of the ordinary micrometer. In the telescope, with such a micrometer, the most exact measurements are not often extended over a minute of arc. And this limit is fixed by the field of view, which decreases as the magnifying power increases. With the heliometer, however, the limit of the distance which can be measured is independent of the magnifying power and the field of view, but is limited by the amount of motion given to the two halves of the object-glass. In the Yale heliometer this motion is about two degrees. Another advantage is the absence of either the bright webs or the bright field of the ordinary micrometer; but this is counterbalanced to some extent by the necessity of making the heliometer object-glass smaller than is usual in equatorials.

The difficulties and expense of construction of the modern heliometer, the fact that it is a special instrument to be devoted to measuring rather than to viewing, and the less difficulty of manipulation of meridian instruments and equatorials, led to the comparative neglect of the heliometer by English-speaking people until the erection of the Oxford heliometer of 190 mm. aperture. Lord Lindsay's admirable volume (*Dun Echt obs. publ.*, vol. ii.), describing his heliometer of 107 mm. aperture, presented in a very forcible manner the precision attained in measurements with comparatively small instruments. An inspection of the measurements executed with the instruments at Breslau (76 mm. aperture), Königsberg (158 mm.), Bonn (162 mm.), and Strasburg (76 mm.) shows a precision for distances over 1 minute not equalled by any other measurements made at the same period by instruments of another class.

The belief that a heliometer of the largest size, and built according to the most recent theories as to material, form, and symmetrical arrangement of parts, would be an important adjunct to the instrumental resources of American astronomy, led to the writer's recommending to the Yale observatory board the acquisition of such an instrument.

The contract with the Messrs. Repsold bears the date of June 11, 1880. The heliometer was erected in Repsold's shops in January, 1882, for inspection, and arrived in New York the following May. About the beginning of September it was in place in the west tower of the observatory.

The figure shows it as erected in Repsold's shop at Hamburg, and without its tripod foot. The object-glass is mounted in the rectangular metal frame A, which contains the two sliding-pieces holding the object-glass halves, which rest on four cylindrical surfaces each 107 × 13 mm., and having a radius 125 mm. less than the focal length of the object-glass. The large rotating disc B contains three sectors of different thicknesses of wire gauze, which can be swung over either object-glass half, to diminish the apparent brightness of either image. This whole head can be rotated in position angle by means of the shallow sheet-iron cylinder, which has a rack with its appropriate gearing attached to it. By this device the motion in position angle is as expeditious as in the common form of position micrometer. The position circle is at P. The slow motions and clamps for all the circles are brought within easy reach of the eye-piece E, by a number of ingenious mechanical devices.

The two small brass oil-lamps, which are carried at the extremities of long arms to avoid their heating effects on the instrument, by a careful economy of the light, and a beautiful arrangement of lenses and mirrors, illuminate the object-glass platinum scales, the scale metallic thermometer, and both the position and declination circle indices, which are all read by their appropriate microscope micrometers projecting from within the cylinder C. The telescope tube is of steel, the circle graduations are on silver; the column axes and counterpoises are of iron, and rest upon a massive tripod foot of 0.85 m. radius. The distance from the surface of the granite capstone on which the tripod foot rests, to the intersection of the polar and declination axis, is 2.9 m. The clockwork, with its connecting rod, is shown at D.

The more important instrumental constants are as follows: aperture, 155 mm.; focal length, 2,495 mm.; maximum arc to be measured, 2°; magnifying power of the eye-pieces, 90, 126, 159, 245. The scale micrometer has a value of 0″.25 for one division of its head; while the hour circle, declination circle, and position circle micrometer divisions have values of 1ˢ, 10″

THE YALE OBSERVATORY HELIOMETER.

and 10″ respectively. The aperture of the finder is 62 mm. The whole instrument is an exquisite piece of mechanical workmanship, and for both design and execution the makers are entitled to the highest praise.

The construction of the object-glass, first offered to the Clarks, but declined by them because of the subsequent cutting in two, was accomplished by Merz of Munich. Its performance, using the Steinheil achromatic eyepieces, is an agreeable surprise. With either half the images are as sharp as with a good four-inch telescope. With the images superposed, there is a loss of the best definition; and this arises from the practical impossibility of adjusting the two halves of such an object-glass so that the images will be absolutely superposed. In actual observing, the greatest difficulty in the way of exact measurement is found in a want of similarity in the atmospheric conditions affecting two celestial objects which are supposably near enough to be influenced alike. Thus the two opposite limbs of the sun, except in the very best observing weather, do not maintain a steady contact together when heliometrically observed, but vibrate, alternately lapping over and receding from each other. In the observations of the last transit of Venus, this peculiarity presented the curious effect of a rapid breaking and forming of a ligament analogous to the 'black drop' described by the older observers when the limbs of Venus and the sun were in contact.

The model on which the whole instrument is constructed is a very great improvement on any previous heliometer, so far as lessening the observer's fatigue is concerned. Every motion is controlled, and every scale and circle is read, by the observer without leaving his seat.

With the cylindical bearings of the object-glass cells, the image distortion for measures up to 2° is rendered extremely small; by the rapid rotation in position angle, and equal rapidity in distance settings, the observer is no longer fatigued by manipulation; and it can be said that in this instrument the heliometer shows itself to be a measuring-machine of the highest precision. LEONARD WALDO.

NOTE ON THE OBSERVATIONS OF THE TRANSIT OF VENUS, 1882, AT THE LICK OBSERVATORY.

BY invitation of Capt. R. S. Floyd, president of the trustees of the James Lick trust, I went to Mount Hamilton to direct the observations of the transit of Venus at the Lick Observatory. The chief instrument of the equipment which the trustees had provided in time for observing the transit was the horizontal photoheliograph, which is essentially similar to those employed by the American commission on the occasion of the transit of 1874, as well as that of 1882, and which are described by Professor Newcomb in the first part of the American observations of the transit of Venus of 1874. The Lick photoheliograph, like all the others, has an objective five inches in diameter; and its focal length is almost exactly forty feet. The heliostat mirror, an unsilvered disk of glass, is seven inches in diameter, and was mounted on a pier adjacent to that which supported the objective. A third pier, coming up in the interior of the photographic house, supported the plate-holder; and all three piers were laid up of brick, their foundation being in the rock of the mountain summit.

I arrived at the observatory in the evening of Nov. 21. The photoheliograph had, in the main, been mounted and got in readiness before that time by Mr. Fraser, the superintendent of construction of the observatory. It remained to complete the unfinished portions of the instrument, to mount and fully adjust the same, to modify some details which had been unsuitably constructed, and to make sure of the convenient and effective working of every part. Especial attention was given to the accurate determination of the position of the focal plane of the objective; and the method adopted — being nothing short of a critical examination, by many persons independently, of several sets of trial-plates exposed at varying distances from the objective — finally indicated the true setting of the plate-holder with much more than the required precision. Great care was taken to insure the perfect definition and figure of all the pictures, and to prevent the mishap of fogged plates from scattering and extraneous light. Much time was consumed in this way in the preparatory work, but we had more than sufficient compensation in the superior character of the photographs of Venus in transit. All these were taken by the wet process, and the photographic operations were in charge of Mr. Lovell of Amherst.

During the important days of the transit-period, the meteorological conditions on Mount Hamilton were especially favorable. At midnight, Nov. 30, the sky cleared, after three and a half days of continuously cloudy weather. From that time until the afternoon of Dec. 7 we saw no cloud, day nor night, which could in the least interfere with any observation we had to make. Thin cirrus was float-

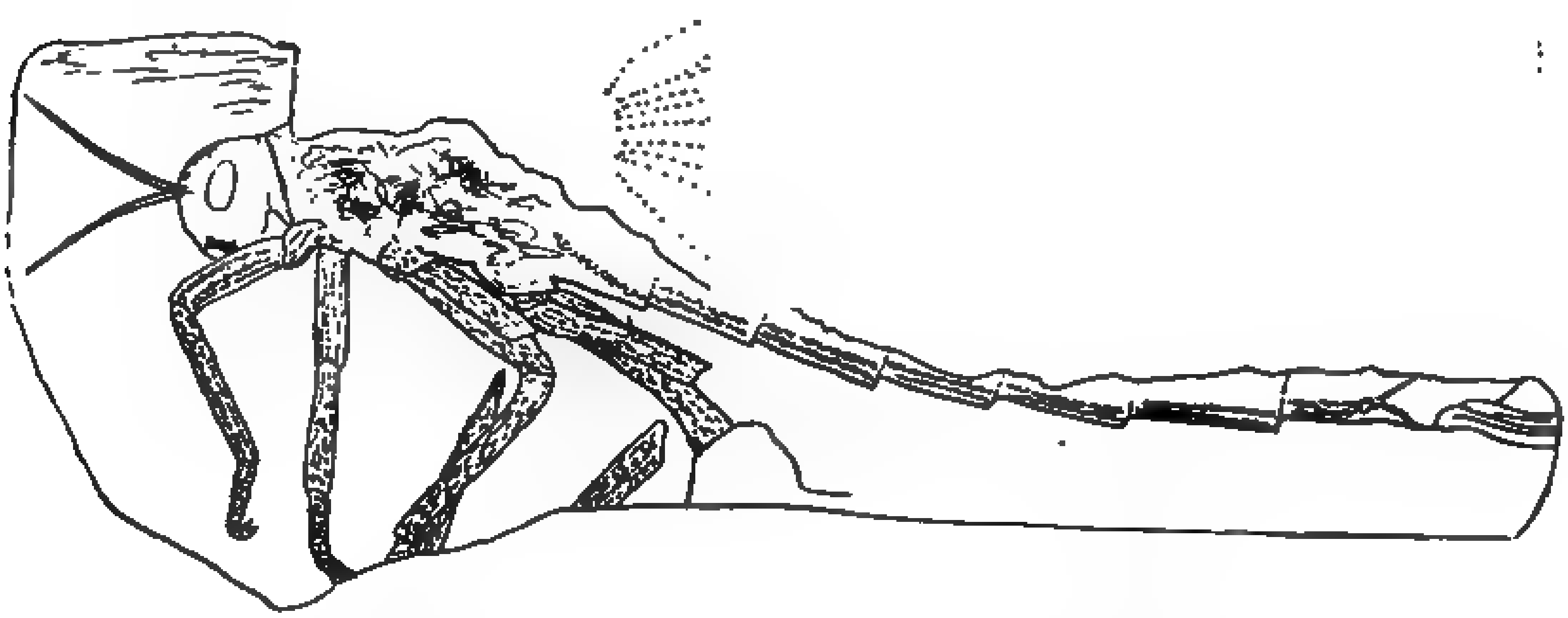
ing above the mountain summit on the morning of the 2d, but it had vanished completely within two hours; and on three or four occasions clouds were observed very near the horizon, but they never rose. Fitful gusts of wind prevailed night and day the 3d and 4th, and the morning of the 5th; but, about noon this latter day, a period of the utmost tranquillity set in, and lasted for fifty or sixty hours, the temperature ranging only between sixty and seventy degrees.

Dec. 6 the sun rose about seven o'clock, with Venus a good way on its disk. The first sensitive plate was exposed at eleven minutes after seven, the slit being three inches wide, and the exposure a second and a half long; but a very faint image was all that came out on the plate in developing. Six minutes later, with an exposure of one second, a picture sufficiently intense for measurement was obtained; but the vertical diameter of the sun was about a quarter of an inch, or one-eighteenth part, shorter than the horizontal one. Something like a half-hour later, very satisfactory pictures began to be obtained, with the slit an inch wide, and an exposure less than half a second long. By twenty minutes past nine the slit had been reduced in width to 0.25 in., and was kept at this setting throughout the remainder of the transit, the exposures varying only slightly from 0.25 sec. in length. At twenty-two minutes before twelve the last exposure preceding interior contact at egress was made, and subsequently ten additional photographs were taken between the two contacts. The total number of plates exposed was a hundred and forty-seven, and about five-sixths of them will be available for exact micrometric measurement. Their number and quality are about as follow: A signifying a plate of the first order of definition, and any two successive grades being separated by only a slight variation in quality: —

Grade.	No. of Photographs.	Grade.	No. of Photographs.
A	71	B—	3
A—	23	C	4
B+	13		—
B	9	Total,	123

The record of the times of exposure of these photographs was kept by two chronometers independently, one record being automatic. The original photographic record, and such parts of the photoheliograph as have yet to be investigated, together with the greater part of the photographs themselves, are now stored for safe-keeping in the vault of the observatory on the mountain.

No other observations of importance were attempted, except those of the two contacts at egress: these being observed by Capt. Floyd, with the twelve-inch equatorial, aperture reduced to six inches; and by myself, with the four-inch transit instrument. DAVID P. TODD.



TITANOPHASMA FAYOLI BRONGNIAT. — ONE-FOURTH NATURAL SIZE.

A GIGANTIC WALKING-STICK FROM THE COAL.

WE owe to the favor of M. Charles Brongniart of Paris, sketches of an enormous insect from the carboniferous beds of Commentry, France, which we have reproduced upon this page; in short preliminary notices, given last December to the Paris academy and the geo-

logical society of France, he has named it Titanophasma Fayoli. The interest attaching to this remarkable creature, which has not before been figured, and to another somewhat smaller species published by him five years since under the name of Protophasma Dumasii, is twofold. First: scarcely any group of Orthoptera is so specialized as the Phasmida, or walking-sticks; and one would naturally look upon these bizarre creatures as the last term in a long series of forms in a special line of development. They had never been found fossil, excepting in one or two fragments in amber, when suddenly the upper coal-measures of Commentry revealed a considerable number of forms, of which M. Brongniart has only described two. He points out, that they differ from modern types in certain features, such as the relative length of the parts of the thorax and legs; but their connection with living Phasmida is unmistakable. Second: the hind wings are of a type very different from those of living Phasmida, and accord closely, as pointed out in my paper on *The early types of insects*, with those of a whole group of detached wings found in carboniferous beds in Europe and America (Dictyoneura, Paolia, Haplophlebium). These have always been looked upon as Neuroptera. It can hardly be doubted that these wings belong to this early type of walking-sticks, — a probability, we may add, strengthened by unpublished material in our possession. Here we have clear evidence of the presence, in early times, of synthetic types of marked character. As M. Brongniart informs me that he has now over five hundred and fifty specimens of arthropod remains from Commentry alone, and as our own Mazon-Creek beds have doubtless yielded as many, we may look for many new revelations concerning the early insect fauna of our globe. I am already acquainted with half a dozen or more species of Dictyoneura and allied genera from our American coal-fields, notably from Pennsylvania. The figures we give are from M. Brongniart's sketches, reduced lineally one-half. The body is that of the original specimen of Titanophasma described in the *Comptes rendus* of Dec. 11. The wing, his latest discovery, and not yet described, has merely been mentioned by M. Brongniart, in the bulletin of the entomological society of France: it was found detached in the same beds, and is conjectured by him, not without reason, to belong to the same or a closely allied species. Of Protophasma, specimens have been found with the wings attached to the body. SAMUEL H. SCUDDER.

ANATOMY AND HISTOLOGY OF POLYOPHTHALMUS.

THIS interesting genus, which was first discovered by Dujardin in 1839, and more fully described by Quatrefages in 1850, is the subject of a fine monograph by E. Meyer in the *Archiv für mikroskopische anatomie*, xxi. 769. The transparent worm is 15-18 mm. long; has twenty-eight bristle-bearing segments, followed by eight smooth, very small ones, none of which are marked externally. The bristles form two rows on each side. Most remarkable are the eyes; of which there are three on the head, and several pairs on the body. In P. pictus, the species investigated by Meyer, there are twelve such pairs, on as many segments. The external cuticula is of nearly uniform thickness, except over the sensory organs, where it is thinned out; but the hypodermis varies considerably, and is composed of narrow cylinder cells and relatively large unicellular glands, which last have granular contents, an oval nucleus, and a cross-shaped opening through the cuticula for the duct. The external coat of annular muscles is very imperfectly developed. The remaining muscles resemble those of other annelids. The bristles arise from the bottom of four pockets in each segment; the pockets (*bursae*) are invaginations of both the hypodermis and cuticula; but the hypoderm cells are cubical, and not cylindrical as over the rest of the body. The brain is kept in place by a set of threads of muscular and connective tissue, which run from various points of the body-wall to the cerebral envelopes. A detailed description of the nervous system is given. The ventral cord is nearly uniform, and has no distinct ganglionic swellings. It lies close against the skin, which directly underneath it is reduced to a thick cuticula with a matrix of flat cells, which pass suddenly on either side into the layer of hypodermal cylinder cells. There are two pairs of peripheral nerves in every segment. The sensory organs are numerous and interesting. The organs of touch are the cephalic and anal papillae. The former is a small elevation of the integument of the forehead, covered with a delicate cuticula and thin hypodermis, and receiving a number of nerve filaments. The nine anal papillae are similar in structure, but project more. There are also the so-called lateral organs, a pair in each bristle-bearing segment, which are probably homologous with the *seitenorgane* discovered by Eisig in the Capitellidae. They lie between the two bristle pockets of each segment, and have the form of hemispherical projections, probably covered in life with free sensory hairs arising from the modified hypodermal cells, which rest upon a peripheral ganglion, from which they are separated by a thin membrane; the membrane is pierced by the cells to establish their connection with the ganglion. There are beaker-shaped organs, having evident resemblance with those of fishes and the Capitellidae, but present only in a single cephalic pair. There is also a pair of ciliated pits of horse-shoe shape on the oral segment. These pits are in structure quite complicated; and their bottom has hair-bearing sensory cells, which are greatly elongated, have rod-like nuclei, and rest upon a ganglionic layer, to which runs a large special nerve. There is an evident histological similarity between the ciliated pits, the beaker-shaped organs, and the lateral organs. The lateral eyes are of two sizes, those upon the eighth to the fifteenth segments, both inclusive, being nearly twice as large as the four other pairs: they all lie close against the integument, the overlying cuticula and hypodermis being both very much thinned. The

oval lens lies close against the hypodermis, and can be strongly stained with haematoxylin. From the inner surface of the lens depend a cluster of prismatic cells, with nuclei in their bases, or ends away from the lens. These cells fill up the interior of the eye, and are enclosed in an envelope, which is fibrous, pigmented, and nucleated. The fibres probably are, in part at least, ramifications of the eye-nerve; the envelope is separated from the inner cells (so-called *glaskörper*) by a limiting membrane. These eyes conform, therefore, in their structure, with the known type of annelidan eyes. The three cephalic eyes are embedded in the brain. Their most remarkable peculiarity is the extension of the envelope of the eyes over the lenses, where it is much thickened. Each eye has three lenses (in P. pictus), but otherwise is similar in structure to the lateral eyes. Three pear-shaped vesicles lie beside the eyes: these Meyer believes to be probably otocysts. The digestive tract has five divisions: 1°, the mouth cavity, is a rather long cylindrical tube; 2°, the pharynx, extends in many windings and folds to the end of the fifth body-segment; it is quite muscular, and has numerous peculiar glands opening into it; these two parts appear to correspond to the fore-gut, while 3°, the oesophagus, seems rather a portion of the mid-gut, since it is lined with ciliated epithelium; 4°, the largest division or stomach proper, which has two ventrally placed glandular coeca at its anterior end; the coeca are lined with an epithelium composed of two distinct kinds of cylinder cells; the stomach has an external wall of fibrous and connective tissue, within which is a close network of large capillaries, which gradually becomes more and more irregular posteriorly; the epithelium over the capillaries is ciliated, but over each mesh there is a single cell, which extends down between the vessels, and itself forms a complete glandular bag, and represents a hitherto unknown type of cell-form; 5°, the end-gut, is very short. The vascular system is well developed, and is described in detail. A short account of the body cavity is given; the structure of the segmental organs was not elucidated. The sexual organs have been accurately described by Quatrefages and Claparède. C. S. MINOT.

THE GLACIAL THEORY BEFORE THE PHILADELPHIA ACADEMY.

AT the meeting of the Academy of natural sciences of Philadelphia, Feb. 13, Prof. Angelo Heilprin, referring to the subject of glaciation, stated that in his opinion the vast ice-sheet which is generally supposed to have covered, during the great 'ice age,' a considerable portion of the northern region of the European and North American continents, could not have had its origin, as is maintained by most geologists, in a polar ice-cap; since it may be reasonably doubted whether any accumulation of snow and ice in the far north could ever have attained a magnitude (in height) sufficient to have propelled a glacier with an estimated thickness of several thousands of feet, to a distance of hundreds of miles, and up mountain-slopes to an elevation of five or six thousand feet.

The height of such snow-accumulation must necessarily depend upon two circumstances: 1°, the quantity of aqueous precipitation; and, 2°, the upper limit in the atmosphere to which clouds may attain. It is well known that as a rule clouds rise highest in the regions of highest temperatures, — the equatorial, — where the vapor absorption by the atmosphere is greatest; and, for a similar reason, higher in summer than in winter. The minimum rise will therefore take place in the polar regions, and necessarily during the polar winter. High (discharge) clouds in the extreme north are stated by arctic explorers to be a rarity, and hence precipitation in the form of snow must be restricted to a comparatively low atmospheric zone.

No great accumulation of snow can take place above this zone, which must consequently be of the height of the ice-cap. As a matter of fact, the officers of the late arctic expedition under Sir George Nares observed that the crests of the greater elevations were devoid of snow, and that in the winter-months there was altogether, even in the low lands, very little precipitation, heavy precipitation beginning only with the spring-months. The greatest snow-clad elevation in Greenland is Washington Land, supposed to be 6,000 feet, which gives origin to the great Humboldt glacier. Although this peak is completely buried in snow (of undetermined thickness), it may be safely doubted whether, unless with a warmer climate, snow of any great thickness could possibly accumulate on a summit of much greater height. If not, the elevation, in the opinion of the speaker, was entirely inadequate to account for the phenomenon of glacial propulsion southward to the extent required by geologists.

Prof. H. Carvill Lewis remarked, that, notwithstanding the difficulties in the way of a theoretical explanation, the fact of a great continuous glacier at the time of maximum glaciation seemed clearly indicated, at least in America, by the numerous observations recently made. He described the extent of the glacier in America, as indicated by its terminal moraine, and stated that the close similarity of its phenomena at distant portions of its southern edge indicated a continuous ice-sheet. The continuous motion of its upper portion is shown by the uniform direction of glacial striae upon elevated points. Thus the south-west direction of the striae upon the mountain-tops of northeastern Pennsylvania was identical with that upon the Overlook Mountain of the Catskills and that of the Laurentian of Canada. The striae at lower elevations conformed more or less to the valleys, and did not indicate the general movement of the ice. The thickness of the glacier increased northward, the rate of increase diminishing as its source is approached. This latter point has not heretofore been appreciated, although observed some time ago by Dr. Hayes in the case of the Greenland glacier.

Recent observations by the speaker in Pennsylvania had shown the glacier to be 800 feet thick at a point five miles north of its extreme southern edge, and 2,000 feet thick at a point eight miles from its edge, while it was only about 3,100 feet thick one hundred miles farther north-east, and about 5,000 feet thick three hundred miles back from its edge. The amount of erosion it caused upon rock surfaces was in some degree a measure of its thickness, being far greater in Canada, even upon the hard Laurentian granites of that region, than in Pennsylvania, where even soft rocks were but slightly eroded.

The present thickness of the glacier in central Greenland was considered, and the magnitude of certain icebergs detached from it given. A friend of the speaker had within a few months seen a floating iceberg near the coast of Newfoundland which stood 800 feet above the water by measurement, and may have been therefore nearly a mile in depth. Dr. Hayes saw an iceberg aground in water nearly half a mile deep.

That the great glacier flowed up steep inclines, was abundantly proven by recent observations of the speaker in Pennsylvania. He instanced the striae

covering the north flank of the Kittatinny Mountain; and a bowlder of limestone perched on the summit, which, within a distance of three miles, had been carried up eight hundred feet of vertical distance.

Referring to a paper recently published by Mr. W. J. McGee, who found difficulties similar to those of Professor Heilprin in the assumption of a polar ice-cap of great thickness, and who imagined the glacier to increase by additions to its outer rim, Professor Lewis held, that the single fact of the transportation by the glacier of far-travelled bowlders to its terminal moraine was a fatal objection to any such hypothesis. Nor did he believe that the hypothesis adopted by Professor Dana and others, of a great elevation of land in the north, was a probable one. The facts now in the possession of geologists do not indicate such a great and local upheaval as required by that hypothesis.

An explanation therefore must still be sought for the southward flow of a continuous ice-sheet, — a flow in some regions up-hill. The action of gravity was certainly not sufficient. Even in the case of the downward flow of the steeply inclined Swiss glaciers, it had been shown that gravity was more than counterbalanced by friction of the sides and bottom, and those glaciers moved by reason of an inherent moving power of the molecules of the ice. It was probable that a similar action occurred in the great continental glacier. He suggested, therefore, a hypothesis which, while preserving the unity of the glacier, as indicated by observed facts, neither assumed an unreasonable land-elevation in polar regions, nor required a thickness of ice so great as to be open to the objections of the last speaker. He suggested that the ice-cap flowed south simply because it flowed toward a source of heat. Such flow does not depend upon gravity, but would occur in a flat field of ice, or possibly even up a slight incline toward a warmer temperature. Upon this hypothesis the ice need not to have been more than a few times its present thickness in Greenland to account for all existing phenomena.

AN EARLY STATEMENT OF THE DEFLECTIVE EFFECT OF THE EARTH'S ROTATION.

A CORRECT knowledge of the deflective effect of the earth's rotation on the motion of bodies on its surface is generally accounted the result of studies made within the last twenty-five years. First in 1856, and more fully in 1859, Mr. William Ferrel of Nashville, Tenn., now of Washington, made the general statement, that, "in whatever direction a body moves on the surface of the earth, there is a force arising from the earth's rotation which deflects it to the right in the northern hemisphere, but to the left in the southern" (*Math. monthly*, 1859, i. 307); and gave, by a rigorous analytical treatment of the question, a quantitative measure of this force, showing that it depended on the sine of the latitude of the body, but not at all on the direction of its motion. A similar but less comprehensive result was arrived at about the same time by Babinet and others (*Comptes rendus*, xlix. 1859); and since then the subject has been treated by many writers, among whom may be mentioned Buff, Finger, Guldberg and Mohn, and Sprung. It has, however, also been disputed by some authors, as Bertrand and Benoni, who erroneously hold to the old idea, first suggested by Hadley (1735), and recalled (it would seem independently) by De Luc (1779), Dalton (1793), and Dove (1835), that the deflective effect is greatest on motions in the meridian and nothing on east-and-west lines; and this incorrect view is but slowly disappearing from the text-books in general use.

It is the object of this note to call attention to an early statement of the law of deflection, that has never, so far as I can learn, received due credit. In 1843 Mr. Charles Tracy, now of New York, read a paper 'On the rotary action of storms' before the Utica (N. Y.) society of natural history; this was published in the American journal of science (xlv. 1843, 65–72), and the paragraphs quoted below are taken from it. It will readily be perceived that this explanation is far in advance of Dove's; although it lacks the consideration of the effect of centrifugal force and of the preservation of areas, to be a full statement of the matter. Mr. Tracy thought, in accordance with Espy's theories, that there must exist "a qualified central tendency of the air, in both the general storms and the smaller tornadoes" (p. 67); and in order to develop a uniform rotary movement in these centripetal winds, he looked to "the forces generated by the earth's diurnal revolution" (p. 66). In every storm, "the incoming air may be regarded as a succession of rings taken off the surrounding atmosphere, and moving slowly at first, but swifter as they proceed towards the centre." In virtue of the law of deviation, every ring "begins to revolve when far from the centre, turns more and more as it draws near it, and finally as it gathers about the central spot all its forces are resolved into a simple whirl" (p. 69). The law of deviation is illustrated by appropriate figures for the two hemispheres, and is explained as follows. (Its *direct* application to the tornado and water-spout is probably incorrect, as Mr. Ferrel has shown.) "The relative motions of the parts of a small circular space on the earth's surface, by reason of the diurnal revolution, are precisely what they would be if the same circular space revolved upon an axis passing through its centre parallel to the axis of the globe. If such space be regarded as a plane revolving about such supposed axis, then the relative motions of its parts are the same as if the plane revolved about its centre upon an axis perpendicular to the plane itself; with this modification, that an entire revolution on the axis perpendicular to the plane would not be accomplished in twenty-four hours. Such plane daily performs such part of a full revolution about such perpendicular axis as the sine of the latitude of its centre is of radius. The plane itself — the field over which a storm or a tornado or a water-spout is forming — is in the condition of a whirling table. Hence the tendency to rotary action in every quarter of the storm is equal, and all the forces which propel the air toward the centre co-operate in harmony to cause the revolution" (p. 72). The special value of this statement lies in the proof that motions in all directions are deflected equally; but on account of the omissions above named only one-half of the total deflective force is accounted for.

W. M. DAVIS.

LETTERS TO THE EDITOR.

'Mother of petre' and 'mother of vinegar.'

CHEMISTS were not a little interested a few years since by the discovery, first announced by Alexander Muller in Germany, and afterwards by Schloesing and Muntz in France, that the formation of saltpetre in nature, and of other nitric compounds as well, is in some way connected with the presence and action of a living 'ferment,' much in the same way that the formation of alcohol in the brew-house or distil-

lery is due to the presence and growth of the yeast-fungus. At the time of the publication of Schloesing and Muntz's memoir, it was remarked in corroboration of their view, that tradition has taught, that in the days when 'saltpetre plantations' or 'saltpetre yards' were worked in Europe, in order to obtain a supply of the nitrate for making gunpowder, pains were taken to use the earth of a yard over and over again, after the nitrate had been leached from it; and that, in order to insure success, when a new yard was to be started, some earth had to be brought from an old yard, and mixed with the new earth, — all of which went to show a recognition of the truth, that something useful for the process of nitrification was contained in the old earth. But the wisdom of the fathers is expressed even more emphatically in the following citation from the 'Diary of Samuel Sewall,' recently published by the Massachusetts historical society (see 'Sewall papers,' vol. 2, p. 10, of the preliminary 'Miscellaneous items'). It appears that in the year 1686 Judge Sewall copied upon the cover of his journal this receipt: —

> "To make a salt-petre bed. All the sward of the ground is to be taken off or trenched in, and the stones to be taken clean out as deep as the trench. Then get the best and richest mould you can, and fill up the trench according as you will make it in greatness — length or depth as you see cause. When the ground is made clean and fitting, turn over the ground and trench it in again, and as you trench it in mix it with strong lime about a tenth or sixth part; and the Seed-Petre, or Mother of Petre, and hen or pigeon's dung as much as you can get, the more the better. And after 'tis trenched in as above, let all the butcher's blood and lees of wine be mixed often with the upper part of the mould about half a foot down, that it be not lost or run away from the bed or bank. Let the bank be made upon rising ground, and a ditch about it, that the water rest not, nor run into the petre-bed; with a dry house over it, to keep it from rain."

Surely it is something more than a curious coincidence that our forefathers should have thus spoken of the 'mother of petre' as they did habitually of the 'mother of vinegar.' In the face of expressions so distinct as these, it is impossible, as a matter of history, to deny that just conceptions of nitrification and acetification were current long ago. It is, perhaps, the fault of their descendants, rather than of themselves, that this knowledge of our ancestors was not more firmly grasped or sooner formulated with precision. F. H. STORER.

Archeological frauds.

As an illustration of the demand and supply of archeological material, I will call attention to a carved stone representing a naked child about two feet in length, which was said to have been dug up near the Hot Springs in Arkansas. The carving was partly enclosed by a cement, which, it was said, covered the stone when it was found. This was received at the Peabody museum, with its history, apparently well authenticated, describing it as an antique. This piece of carving proved to be a child of the 'Cardiff giant' family. The fraud was unquestionable; and the image was returned to its owner with a full statement of the evidence against it, and the request that in the interest of science the object should be destroyed. Since then I have heard nothing more of it, and in case it has not been destroyed this notice will serve to put others on their guard. This is, however, but one of the many fraudulent specimens offered for sale; and we have received a number of pipes, tubes, dishes, ceremonial and other objects, made in Philadelphia, and sold as having been found in such or such a locality. The variety of these articles made by the Philadelphia manufacturer, and the character of the work, are such that many have found their way into collections in this country, and not a few have supplied the foreign demand for American antiquities. A manufacturer in Indiana confines his attention chiefly to 'mound-builders' pipes,' which are carved from stone, and offered in a systematic method to collectors. In Ohio a large business has been done in the so-called gorgets, cut from blue slate, and in hematite celts. In southern Illinois, a few years ago, many specimens of pottery were made, until the demand fell off so that one manufacturer acknowledged that he was no longer paid for his trouble by their sale. Another man who made this pottery is, I believe, no longer living; but much of his work is still extant. This list might be lengthened; but it is already sufficient to show that the demand for 'antiquities' is considerable in this country, and that we are not behind the old world in keeping up the supply. F. W. PUTNAM.

Cambridge, Feb. 19.

AMERICAN INSTITUTE OF MINING ENGINEERS.

THE American institute of mining engineers, organized in 1871, and consisting at that time of mining and mechanical engineers, metallurgists, and chemists, held its second February meeting in Boston, in 1873, with a membership of about two hundred and fifty. Since that time the American chemical society and the Society of mechanical engineers have been formed, in a measure limiting the field of the institute to the mining engineers proper, the metallurgists, those chemists who are engaged on the problems connected with the profitable extraction and working of metals, and those geologists whose work lies in the same direction. But, even with this specialization of the aims of the institute, it has just held its twelfth annual meeting in Boston, Feb. 20–23; and the membership at present numbers over twelve hundred.

The decade which has elapsed between these two meetings has witnessed a most marvellous growth of mining and metallurgical enterprises. It is now very generally recognized that our mineral resources in extent and richness rival those of any other country. It is, on the other hand, true that the mining-lands of America present obstacles to the extraction and transportation of their mineral wealth such as no

other country has to contend with. The ores, too, are of much more refractory nature, and the laws of the deposits very different from those that govern the veins and beds of the eastern continent.

The novelty and the difficulty have attracted to this field of research a number of Americans of liberal education fitted in the schools at home and abroad. The magnitude of the obstacles and the difficulty of the problems encountered in the field have only served to stimulate their mental energies, and have drawn hither a goodly number of foreign scientific and practical men, who have sought in this untried field an opportunity to win greater laurels than was offered by the better-known regions of Europe. All these causes have brought together a body of men of a degree of keenness of intellect, versatility of powers, and acquired skill in overcoming difficulty, which is rarely found in any association at home or abroad.

To the meetings they bring the freshest thought on the newest problems; and those of kindred pursuits have the means of informing themselves as to the progress in their several departments.

Besides the February meeting, which has always been held in some eastern city, one or two expeditions are taken each year to mining regions, where methods and processes are carefully examined and criticised. This close contact of the laboratory and the office with the field results in a union of theoretical and practical science which cannot fail to effect a great development in the metallurgical art.

The Boston meeting, which has just closed, was attended by about seventy-five members. Twenty-eight papers were presented, of which thirteen were read and discussed. Abstracts of these appear in the following pages. Some idea of the range of thought at one of these meetings may be gained from the following classification of the papers: In metallurgical subjects, ten papers were offered; in mining and ore-dressing, six; in geology, five; in analytical chemistry, three; in characters of iron and steel, two; and two unclassified.

Besides the five sessions for the reading of papers, there were three excursions to works of engineering interest. The first was to the pumping-station of the new sewerage system at Old-Harbor Point. The chief objects of interest were the two great pumping-engines, each with two plungers, four feet in diameter, and nine feet stroke. One of the engines was started for the benefit of the visitors, and they were informed that it was pumping about thirty-seven million gallons per day. One of these pumps would be able to pump the Charles River dry if its outlet to the sea were stopped by a dam. The sewage is here lifted forty-three feet in order to gain column enough to carry it out to Moon Island. On the way home the party visited the Norway iron-works, and inspected the new petroleum furnaces, which are said to replace one ton of coal with two barrels of crude petroleum; and also the Billings cold-drawn shafting apparatus. Later the Carson trenching apparatus was inspected, whereby a sewer may be constructed through the crowded streets without stopping the travel.

The second excursion was to see the celebrated testing-machine at the Watertown arsenal. No European nation has a testing-machine of equal capacity and precision of measurement; a piece of steel tested was a flat bar of the manufacture of the Norway iron-works, of twelve-hundredths carbon. Its length was 80 inches; width, 5.85 inches; thickness, one inch. Under tension it stretched eighteen inches, and broke when a force of 288,300 pounds had been applied, which is 49,282 pounds to the square inch. In the afternoon several of the buildings of Harvard university were visited, including the Museum of comparative zoölogy, the Peabody museum of American archeology, the gymnasium, and the chemical laboratory and museum of minerals in Boylston Hall. A lunch was served in Memorial Hall.

The third excursion, was made to Lowell; and the party visited a cotton-mill and print-works, besides a carpet- and a hosiery-mill, all of which proved of great interest to the members living out of New England.

Microscopic analysis of the structure of iron and steel.

BY J. C. BAYLES OF NEW YORK.

After briefly reviewing the work of A. Martens of Berlin and Dr. H. C. Sorby of Sheffield in this field of research, Mr. Bayles considered the methods of preparing specimens for microscopic study which in practice he had found to give the best results, and continued: The first step to be taken in practical microscopy is the training of the eye to observe what may be seen without the aid of a lens. This is accomplished by the patient examination of characteristic fractures, and noting similarities and differences. After the naked eye has become familiarized with all it can see, the student should continue his investigations assisted by a hand-lens with a power of from two to three diameters, and absolutely achromatic. Specimens to be studied with a view to determining their internal structures should be surfaced in a planer, and smoothed by draw-filing in the direction of the fibre. The surface thus obtained is treated with slightly diluted nitric acid, which gives a rapid and wide development of the structure, which may be studied with advantage while it lasts, and will prepare the student for finer work. For fine development more care and time are needed. After planing, the surface of the metal is ground with fine emery, or under a metallic mirror-grinder. It is then treated with acid, Mr. Bayles describing the manner in great detail. A thorough development with weak acid requires from twenty-four hours to six days, according to the composition of the metal. Small specimens are prepared by planing down from the back to a thickness of $\frac{1}{32}$ to $\frac{1}{16}$ of an inch. The planed face is then ground and surfaced on a fine whetstone, developed with weak acid, and mounted between glasses with Canada balsam. In selecting a microscope, care should be taken that the lenses give a good definition, that there is no 'shake' or lateral motion in the adjustments for focus, and then the table should admit of inclination at any angle found most convenient for observation. Concerning the results to be expected from the microscopic analysis of metals, Mr. Bayles expressed the belief that it opens a vast field of knowledge not yet reached by either chemical analysis or physical test. There are many conditions, the result of changes produced by mechanical treatment, to which chemical analysis gives no clew, and which are detected, but not explained, by the tests of the physical laboratory. The microscope will, no doubt, explain many of the mysterious changes which occur in metals of given chemical composition under different conditions, and will give the metallurgist an opportunity of studying the anatomy and physiology of iron and steel, which, in a most important sense, will supplement analysis and mechanical test, which have thus far, to some extent, run in parallel lines. When, between the report of analysis and the fracture of the broken test-piece, we can place a polished longitudinal or cross-section of the material, its internal structure developed by acid, and admitting of careful microscopic study, we are furnished with the missing link in the chain of evidence required for a correct conclusion as to the nature of the material under investigation.

Coal and iron of Alabama.

BY DR. T. STERRY HUNT OF MONTREAL.

After referring to the researches of Profs. R. P. Rothwell and Eugene Smith, and complimenting them in high terms on the results of their labors in that section, Dr. Hunt said that the existence of coal in Alabama had been known for half a century: it forms a part of the great Appalachian coal-basins, which lie principally upon the waters of the Ohio, and has an extent of 58,000 □ miles, including eastern Tennessee, the north-western corner of Georgia, and a large part of the state of Alabama. The principal part of these measures has an area of 5,000 □ miles; but on the east side are two small detached basins, — the Cahawba, 230 □ miles in extent, and the Coosa, 100 □ miles. They are separated from the main basin by narrow belts of older rocks a few miles in width; and there is no doubt that they are detached portions separated, — the one by a fault pure and simple, the other by an undulation which has overturned the folds, and has faulted them in some places. To the east of these, stretches the Coosa valley, a geographical feature of the greatest importance, being a continuation of the great limestone valley which runs up to Lake Champlain. On the eastern border of the valley is a great belt of crystalline rocks, of which the Blue Ridge, Hoosac Mountain, etc., are a part, and forming the great Atlantic belt from the hills of New England to Alabama. Next is a limestone valley forty or fifty miles in width. Then we have the North Mountain, which is the beginning of the great series of folds which make up the Alleghany Ridge, and formed of paleozoic rock which underlies the coal. To the west are the great coal-measures, essentially the same in character as those of Pennsylvania and Virginia. A peculiarity of the underlying bed of sedimental rock is its varying thickness, from 18,000 feet in Huntington County, Penn., and diminishing toward the south, until in some places in Alabama it has thinned down to 1,800 or even 1,000 feet of soft rock, sandstone, and shale.

The ores in the limestone valley are limonite, and the brown hematites found in Berkshire County, Mass., enormously developed; furnishing a large part of all the ore which is smelted, and practically inexhaustible for generations to come. In the mountain belt is another set of iron-ores, also important, — the red hematites of the Clinton group. Beyond that are coal and occasional clay ironstones, of secondary importance as regards amount. In the northern portion of these beds, especially in Pennsylvania, the North Mountains separate the coal and iron by distances of 100 miles or more, offering serious drawbacks, and increasing the cost of production; at the same time the Atlantic belt renders it impossible to reach the region by navigation. But a remarkable fact is the almost complete disappearance in Alabama of the two great mountain barriers before reaching the sea, being thinned out and worn and ground away. The southern rim of the basin is broken down, and the coal and iron are on a level with the navigable waters of the gulf at Mobile; bringing up the question of the importance of rendering the rivers navigable so as to reach the heart of the coal-region. The coal-measures to the south suffer no diminution in quantity or quality; but the bed-rocks are so upturned and folded and faulted, that within three or four miles the coal and iron are found together. A curious fact of the enormous fault — this great break in the stratification of nearly 10,000 feet — is, that it has brought up the hematite ores directly beside the coal in the Cahawba valley, so near that by the simple means of gravity they may be brought to a common point, reducing the cost of production to the lowest. To these geographical and geological conditions the region owes its future importance. It is the part of the country which is growing most rapidly in population, showing an increase in ten

years of 41.6% against 30% for the nation; it includes the states where agriculture and the carrying trade are to be built up, requiring coal and iron; and they can be obtained under the most favorable conditions. Its significance was long ago noted by Isaac Lothian Bell, who found its ores richer and its fluxes much nearer than in Yorkshire; and he said that the region matched and more than matched anything in Great Britain. Abram Hewitt regarded it as important, reckoning not by the wages paid, but by the number of days of labor necessary to produce a given quantity. Dr. Hunt predicted a most remarkable future for the coal and iron regions of Alabama.

President Rothwell stated that he must disclaim any credit for original investigations, his first knowledge coming from a careful survey and plan made by Joseph Squires.

Dr. Hunt replied, that, had he been aware of it, he would have been glad to give due recognition to the labors of Mr. Squires.

Changes in the structure of block-tin.

BY PROF. R. H. RICHARDS OF BOSTON.

The speaker exhibited a pig of the metal, which in December last appeared to be perfectly good malleable block-tin; Feb. 15, the pig was found to be brittle, and had undergone a change in its molecular condition which involved about half of the mass. It made itself apparent by enlargement in spots which took on a darker color, and which revealed a crystalline structure very like that of stibnite. It was surmised that the change was due to imperfect retorting, leaving in the tin a small percentage of the mercury with which the metal was originally treated; and an analysis of a portion of the pig, using a current of hydrogen at a bright red heat, showed by the direct method the presence of 2.62 parts of mercury to 97.24 of tin; or, by difference, 2.76% of mercury and 97.24% of tin.

Dr. T. Sterry Hunt said that such changes had been previously noted in tin supposed to be in a state of purity, the metal becoming so crystalline that it was almost ready to fall in pieces. Under certain conditions, very like those stated by Prof. Richards, it had been ascertained that block-tin would undergo these changes.

A suggested cure for blast-furnace chills.

BY H. M. HOWE OF BOSTON.

These chills, as well known, are the results of a falling of the temperature below that needed for the fusion of the slag, from 1,800° C. to 1,900° C. The common remedies are the injection through the tuyeres of liquid petroleum, or of air-gas, and the increase in the temperature of the blast, rather than hastening the latter; since this tends to lower the temperature at the tuyeres, just as, up to a certain point, blowing a match, or fire, or candle, will increase its combustion, but beyond that point will decrease it. The difficulty with the use of liquid petroleum is, that it is not generated at a sufficiently high temperature, and the process of vaporizing it within the furnace also requires additional heat. He suggested, that instead there should be used vapor of petroleum or coal-gas, heated externally, so that the energy needed for that operation would not be taken out of the furnace. When cold liquid petroleum is used, there is not enough margin in temperature to avoid chills. The results of his observations were expressed by the following figures, the temperature being in centigrade degrees: —

	Initial Temperature.	Final Temperature.	
		Complete combustion.	Incomplete combustion.
Air-gas	482	2383	1323
Liquid petroleum . .	15	2885	1698
Vapor of petroleum .	482	3967	2117

In discussing the paper, Dr. Raymond of Cambridge said, that, at the Durham furnace, a chill had caused a large scaffolding, which had fallen suddenly, and had choked up the hearth. Liquid petroleum introduced through the tuyeres, with the blast at 900° Fahr., had burned a large hole in the mass, although it was not thoroughly successful in doing away with the obstruction; but a very high temperature was produced within a few inches of the tuyeres. He questioned whether the petroleum in the form of a fine mist, or spray, would not give a higher result than the vapor.

A member said that the chills were produced by the formation of scaffoldings, which prevented the descent of the fuel, and the proper reducing atmosphere could not be maintained. He was of opinion that the petroleum vapor would not remedy this unless carbon were introduced with it. Mr. Howe replied that he would introduce an excess of the gas.

President Rothwell asked if the combination of carbonic oxide and hydrogen, known as water-gas, had been tried. In recent experiments in Germany, in pipe-making and for welding purposes, introduced with air it had given a very high temperature.

Mr. C. Constable, of Constableville, N.Y., thought that 'chilling,' as here used, was a misnomer; that the air of the blast was only capable of burning so much, and, when in excess, a portion of it was driven up in the furnace, and caused the scaffolding. His remedy was a reduction of the blast.

The metallurgy of nickel in the United States.

BY PROF. W. P. BLAKE OF NEW HAVEN.

Nickel has for a long time, and until within a few years, been a compound rather than a simple element, so far as it was known commercially. It was extracted as a secondary product from cobalt spia, and of necessity was a very impure result, being contaminated with a great many other substances, especially arsenic, iron, and sulphur, which were present in small quantities, but sufficient to destroy, to a great extent, the true properties of the metal. In this respect nickel is essentially the same as iron, and these metals and steel offer many analogies when in a state of alloy or combination. For a long time cobalt was the principal object sought, and nickel was a by-product; but the production of artificial ultramarine diminished the demand for cobalt, and at the same time the introduction of nickel-plating and kindred industries increased the call for nickel, until now the conditions are reversed, and the latter metal is in the greater demand. But to the scientific chemists, who prepared nickel in a state of purity, its properties were not wholly unknown; yet between them there was a great diversity of opinion, — one declaring it to be malleable, and another the reverse. Its malleability was diminished by the presence of carbon or manganese; and, reduced by carbon, its ductility was less than that of zinc. These results, however, were confined to chemists and laboratories, and were not known to the arts; and the production of nickel con-

tinued as an alloy, with 2% or 3% of foreign matter, sufficient to destroy its malleability and ductility, and prevent its usefulness in the arts. The first demand for the metal was for nickel-plate, and next for making coins; being first used for the latter purpose in Switzerland in 1850, and in the United States in 1857, although as early as 1853 Booth of Philadelphia had made sample coins, and submitted them to the mint, but they were not accepted. The alloy varied from 5 parts of nickel and 95 of copper to 30 of nickel and 70 of copper. This country first adopted the ratio of 12 to 88; and at present, in the five-cent nickel coins, uses 25 parts of nickel to 75 of copper. Of these five-cent pieces there were issued up to June 30, 1876, the value of $7,000,000. Another large demand for the metal was occasioned by the discovery of the possibility of depositing it by the action of electricity.

Nickel ores are extensively distributed through the United States, more generally than is usually supposed. It is found with chrome ores in serpentine rocks which have a coating of nickel-oxide or emerald nickel, and is also commonly associated with magnetic pyrites; particularly in Connecticut, by the Hudson River, in New Jersey, and at Lancaster Gap, Penn., which is the chief source of the metal in this country. The general diffusion of nickel is pointed out by Dr. Hunt in the magnesian rock at Quebec; at Silver Harbor, on the shores of Lake Superior, is another supply; and a valuable deposit has been found in Nevada, whence last year there were shipped ten tons of the ore to Swansea. Another deposit, closely resembling that of New Caledonia, a hydrated silicate of nickel oxide, and carrying as high as 10% of the metal, has been discovered in Douglas County, in southern Oregon; the Lancaster-Gap ore contains only 1½% to 2% of nickel, with magnetic pyrites. A few years ago the discovery of the hydrated silicate at New Caledonia attracted a great deal of attention. It was at first thought that the deposit was small, and would rapidly be exhausted; but it has proved to be of sufficient extent to supply now nearly all the works of Europe, and is very pure.

In 1876 a remarkable series of objects was exhibited at Philadelphia by Professor Wharton, being nothing more nor less than a number of articles made by that gentleman of pure wrought nickel. They did not attract by any means the attention to which they were entitled; and the same fate befell them at Paris in 1878, where they seemed insignificant beside the splendid cases of alloyed products exhibited by the French workmen, these cases containing, however, not one piece of the pure metal of over three or four grains weight. Professor Blake called the attention of the chairman of the board of judges to these wrought-nickel goods. That official was inclined to be incredulous, but cut a small piece off a square bar, and took it to his laboratory. The next day he informed his associates, that this exhibit of Professor Wharton was beyond comparison, and that they were in the presence of one of the most important results of the age in this direction. This step paved the way to greater advances; and experiments were begun in Westphalia on the mechanical combination, or welding, of nickel with iron and steel. As a result there have been produced sheets of iron and steel coated with nickel on one or both sides, this end being accomplished by securing plates of the baser metal of proper surface, on which are laid the plates of nickel: these are then heated, and passed through rolls under high pressure. The thickness of the nickel is a tenth by weight on each side. The applications of this coated metal will suggest themselves. It is chiefly used in the manufacture of hollow-ware, being readily spun and pressed; and its advantages of lightness, strength, and infusibility, are apparent. These results have also been obtained by Professor Wharton at Camden, N.J.; who has also succeeded in making objects of cast-nickel, the door-knobs in his residence being of this material. There is a great future in this industry, which gives additional importance to all localities where nickel is found; and it is also of interest scientifically. A proposition has been made to use pure nickel for the magnetic needle, and one was exhibited at Paris in 1878. It was afterward presented to the French government, and a commission was appointed to test it: their report has not yet been made.

Professor Blake exhibited to the members of the institute several of the articles shown by Professor Wharton at Philadelphia and Paris. They included a knife, a bent bar, a horse-bit, etc. The bit, it was explained, had not been rubbed or polished since it was sent to Paris in 1878; yet it had not the slightest appearance of tarnish about it. There were also shown specimens of the hollow-ware made in Westphalia. In reply to questions, Professor Blake stated that these vessels were presumably harmless, as the nickel is not easily attacked by vegetable acids; and, further, that the experiment had been tried of feeding a dog on nickel-salts, on which the animal seemed to thrive. It is more economic and more rapid to coat the plates by rolling than by electrolysis.

The Bower-Barff process.

BY MR. BOWER OF ENGLAND.

Mr. G. W. Maynard was announced to read a paper on the 'Bower-Barff process;' but he stated that Mr. Bower of England, one of the discoverers of the process, was present, and could do better justice to the subject. Mr. Bower said, that any process which has for its object the preservation of iron and steel from rust, and which will make these metals more applicable than they now are to the requirements of mankind, will be sure to meet with attention from all those who are either engaged in the extraction of the ore, its reduction to metal, or the subsequent application of the metal itself. With iron and steel rendered secure against corrosion, they will be used to an infinitely greater extent than they now are. The whole realm of science has therefore been explored in the attempt to discover some method by which the formed article may be preserved, leaving its strength undiminished by the action of rust. Paints, oils, varnishes, glazes, enamels, galvanizing, electro-depositing, and what is called 'inoxidizing,' are among the many systems now in vogue to effect the preservation of iron and steel from the corrosive action of air and water. The object of this paper is to show what may be done in protecting iron and steel from rust by forming upon their surface a film of magnetic oxide by an inexpensive process. Russian sheet-iron is less affected by exposure than the ordinary material because of this formation, but this was not known until Dr. Percy discovered it. That such a coating is produced is quite certain, but it is only an accident of manufacture. To Professor Barff is due the credit of being the first to deliberately undertake to coat iron and steel with magnetic oxide produced designedly for the purpose of protecting their surfaces from rust. Some sixteen or seventeen years ago my father was making a series of experiments in the production of heating gases, one set of them being on the decomposition of water by passing superheated steam through masses of red-hot iron. He noticed that the iron became less and less active, until it

ceased to decompose at all; when, on examining it, he noticed that it was coated with a kind of enamel. It at once occurred to him that the process in question might be used to obtain such a coating; but he found, after a few days' exposure of the iron to the atmosphere, that the coating scaled off, and he pursued the matter no farther. The iron employed in this case was rusty; but if it had been new, my father would in all probability have been the accidental author of the process which Professor Barff discovered ten years later. That consists in subjecting iron or steel articles to the action of superheated steam; and, when they are at a temperature sufficiently high, the following chemical change takes place: $3\ Fe + 4\ (H_2O) = Fe_3O_4 + 8\ H$. My father thought that what Professor Barff could effect with steam, he might also effect with air; and experiments were made varied both in character and results. On considering the fact that air is oxygen and nitrogen in mechanical combination only, I came to the conclusion, that, to form the lower or magnetic oxide, the quantity of free oxygen, and so of the air employed, must bear some proportion to the surface of the articles exposed to its action, more especially when a comparatively low heat is employed; and it has been found that the quantity of air passed through the retort during most of the unsuccessful experiments was three hundred or four hundred times more than was actually necessary. The mode of action I adopted was to admit a few cubic feet of air into the retort at the commencement of every half-hour, and then leave the iron and air to their own devices; the retort, of course, being tightly closed. During each half-hour a coating of magnetic oxide was formed, and the operation was repeated as often as was considered necessary. This was effective, but costly; both this and the Barff process requiring the external heating of the chamber. Successful experiments were made with air, but open to the same objection in regard to cost. Experiments with carbonic acid, produced by the decomposition of chalk, which should give $3\ Fe + 4\ (CO_2) = Fe_3O_4 + 4\ (CO)$, gave a coating of light color and easily removed; the film probably being a mixture of FeO and Fe_3O_4, or something nearer the metallic state than is magnetic oxide. But, even if successful, the cost of this method would still be too high. I therefore proposed to use a fuel gas-producer, similar in principle to the Siemens generator, but altered to suit other requirements; to burn the combustible gases thus produced, with a slight excess of air over and above that actually required for perfect combustion, and to heat and oxidize the iron articles placed in a suitable brick chamber by these products of combustion. I also arranged a continuous regenerator of fire-clay tubes underneath the furnace; so that the products of combustion, leaving the oxidizing chamber, passed outside the tubes, imparting a portion of the waste heat to them, which was taken up by the in-going cold air passing through their interior on its way to the combustion-chamber. I had hoped in this way to be able to so regulate the excess of air over that required for complete combustion, as to be able to produce magnetic oxide direct, instead of the lower and useless oxide or combination of oxides. I obtained some beautiful results, and some again were unaccountably bad; and I soon found that it was as difficult to regulate the precise amount of oxidation as it first was in the Bessemer process. But I was fortunate enough to hit upon an almost parallel remedy; that is to say, I increased the quantity of free oxygen mixed with the products of combustion, and oxidized the iron articles to excess during a fixed period of generally forty minutes, when magnetic oxide was found close to the iron, and sesquioxide over all. Then for twenty minutes I closed the air-inlet entirely, leaving the gas-valve open, and so reduced the outside coating of sesquioxide to magnetic oxide by the reducing action of the combustible gases alone.

The Barff patents have been purchased by my father. His process is better than ours for wrought iron, and perhaps for polished work of all kinds, as iron commences to decompose steam at a very low temperature, — in fact, much below visible redness. For ordinary cast iron, and especially that quality which contains much carbon, the Barff process is much too slow in its action; and some specimens that I have treated in England have taken as many as thirty-six hours to coat effectually, which could readily have been finished off in five hours by the Bower process. The main distinction between the two is, that the Bower is much more energetic in its action. The objection to the use of a closed muffle externally heated in the Barff process has been almost entirely overcome by simply putting wrought iron into a Bower furnace previously well heated, then shutting off both the gas and air supplies, and admitting steam into the regenerator tubes. Steel, I consider, can be equally well treated by both processes; except polished steel, which is better treated in a low-temperature Barff furnace. Of the fuel burnt in the gas-producers, a non-caking coal is the best. Virginian splint has suited very well in this country; and of this about one ton every three days is required for a furnace with an oxidizing chamber 13 feet long and 4 feet 3 inches wide and high. When a gas-coal is employed, it should be fed through the charging hoppers just before each deoxidizing operation, when a smoky flame is of great advantage. I have, however, discovered that anthracite coal can be used as well as a gas-coal by simply allowing petroleum to drop, at the rate of one gallon per hour, upon the red-hot surface of the coal in one of the producers. This method has been exclusively used in this country.

These magnetic-oxide processes not only protect from rust, but the coating is of such a beautiful color as to render articles ready for the market directly they are out of the furnace and cooled. One remarkable feature of these is, that there is no more cost (except in the labor of handling them) in treating 2,240 articles each weighing a pound than in coating a cube of the metal weighing a ton; and so penetrating is the process, that every crevice, no matter how intricate the pattern may be, is as effectively coated as the plainest surface. There is absolute certainty that paint used on iron so coated will adhere as well as on wood or stone; and thus iron may be used for construction work in a thousand directions in which it has not up to the present time been possible on account of its liability to rust, no matter what the coating used to protect it has been. Manufacturers appear far more ready to apply the processes here and on the continent of Europe than, up to now, they have been in England; but perhaps the reason has been, that, so far as Professor Barff's process is concerned, it has only just been shown how large masses can be dealt with by the use of the Bower furnace. For ordinary hollow-ware for kitchen or table use, whether of cast or wrought iron, the process is admirably adapted. It is intended to apply the process to cast-iron gas and water pipes; and, as the former have comparatively little pressure to bear, they may be made much lighter if rendered incorrodable: while, for water, there is no reason now why wrought-iron or mild steel pipes should not be used. In the case of railway-

sleepers in iron and steel, which are now almost wholly used in Germany, the process is likely to prove of much advantage. For fountains, railings, and all architectural work, the process is invaluable; and iron may now be used in many instances instead of bronze. The cost has been carefully estimated at two dollars per ton; and this may be reduced by giving several furnaces in charge of one workman, and by a better system of taking the articles out than that in use when the estimate was made. Tests have been made as to the effect of the process on the strength of the metals, with the result that no alteration was detected in the strength. Theoretically one would suppose that iron and steel would be somewhat toughened, as the tendency of the process is to anneal, and would, no doubt, if continued long enough, render some classes of cast-iron malleable. A very thin article, if excessively coated, might probably be weakened, due to the fact that the coat of magnetic oxide would form an appreciable percentage of the bulk of the article; but that, of course, is a very extreme case, and one which is not likely to ever occur in practice.

Note on the jacketing of roasting cylinders at Deloro, Canada.

BY PROF. R. P. ROTHWELL OF NEW YORK.

The speaker said, that he merely desired to place on record the fact that he had been using roasting cylinders jacketed, to prevent any one from taking out a patent on the idea. He did not wish to deprive any one of the privilege of using it, but he also did not wish to be deprived of that privilege himself. In the roasting of arsenical sulphurets he had employed what is commonly known as the White and Howell cylinders, of plain boiler-iron, with fire-brick lining and shelves. He used two of them; the ore passing from one to the other through a pipe, without losing its heat. The first cylinder is 30 feet long and 5 feet in diameter, and takes out a large part of the arsenic and sulphur. The second is 24 feet long and a little less than 4 feet in diameter, in which the roast is finished. The two make a complete roast for chlorinating, and give from 94% to 98% of the gold. But these cylinders radiated an immense amount of heat, too much to allow the temperature to be kept sufficiently high to obtain a complete roast. This loss by radiation has been avoided by jacketing. A sheet-iron jacket is placed around the cylinder, leaving an air-space of two inches; outside of this is another jacket with a space of two and a half inches, which is filled with mineral or slag wool; this is mixed with plaster of paris, and further covered with roofing-paper bound on with wire. Immediately upon the use of this apparatus there was noticeable a tremendous reduction in the consumption of fuel required, and a remarkable increase in the amount of ore roasted. As thus made, it even resulted in heating the upper portion of the first cylinder too much, and roasting too quickly, not leaving in the ore the sulphur necessary for the treatment in the second cylinder. The trouble was remedied by removing eight feet of the jacket around the upper part of the cylinder.

Geological relations of the topography of the South Appalachian plateau.

BY PROF. W. C. KERR OF WASHINGTON.

By aid of a rough black-board sketch of the Blue Ridge and Smoky Mountains, the backbone of the system, the speaker showed from a study of the rivers, that the plateau has been gradually travelling westward. A series of spurs are thrown out by the Blue Ridge on the east, making a drainage system of cross valleys; here are the head-waters of the Tennessee river, which force their way through the great escarpment of the plateau, and through the Smoky Mountains, which in some places attain an altitude of 6,000 feet. This is a very remarkable and curious fact. The cañon through which the waters break is 4,000 feet deep, and has rocky sides not easily removed or eroded. A study of the situation shows, that since the establishment of the water-system there has been slow and steady rise of the mountain chain, the waters at the same time cutting their way down. There is another curious feature in this connection: the Tennessee river runs between this chain and the Cumberland ridge, and it would naturally be supposed that there is a rise from the west side of the river to the Cumberland. But observations with the barometer show, that there is really a continuous descent from the top of the Smoky Mountains to the base of the Cumberland chain, and here we have a river running at a higher level than its tributaries. The explanation is simply, that the Cumberland ridge has been gradually sinking since the establishment of the water-system.

The collection of flue-dust at Ems.

BY DR. T. EGLESTON OF NEW YORK.

In the treatment of silver from lead-ores, this subject is a matter of growing importance in Ems at the works under the charge of Herr Freidenbach, and of some importance here. In 1874 it was found at Ems that there was a considerable loss of product by the dry method, and the wet method was substituted; and still the loss of dust was much greater than had been supposed. There were three difficulties to overcome: to arrest the material carried off by mechanical means, to collect the material which is volatilized, — these two problems being comparatively easy of solution; but, when the collection was made, it was another thing to keep the material collected where it was, and prevent its further loss. The works are located on a plateau and hill. They run first down the valley, and then, turning on themselves, up the hill, continuing in a straight line to the top, where there is a chimney. In 1874 the length of the flue was 460 m., and it was furnished with the old style of condensing-chambers. The canal was then lengthened to 2,000 m., and carried to the flue 200 m. above the bed of the river. It was noted at once, that there was an immediate precipitation of flue-dust, much larger than had been anticipated, but still not effecting a sufficient reduction of the loss. An examination of the pipes led to the adoption of iron pipes, with the lower part terminating in zigzags 75 cm. deep, through which, by means of a door and close-fitting tube, the dust could be drawn out of the flue. This dust was rich, and the results of the method were satisfactory until the assays showed that much matter was lost by volatilization. Freidenbach soon found that the old-style arched flue was the worst that could be used; for, while its form gave strength to resist pressure from without, it also rendered it weak against pressure from within, and the gases found a comparatively easy means of exit through it. The flues were then made rectangular, bound together with iron, and made as tight as possible to prevent the escape of vapors. This form is now adopted everywhere. In the length of the flue was a series of condensation-chambers, but these were found to give no great results. The flue was now 2,600 m. in length, with an area of 42,650 □ m., and had cost 255,000 marks. A series of condensation-houses was built beyond the chimney,

and still the results were unsatisfactory. It gradually became apparent that what was wanted was surface, and not volume. The iron pipes before described not having been affected, there were introduced into the flue sheet-iron plates hung vertically. Four of these plates were at first put in; but the results were so immediate and so gratifying, that the number was increased to six, with still better effect. The conclusion was at once jumped at, that the flue would stand all the plates that could be put into it; and accordingly seventeen plates were introduced, having a space of 10 cm. between them. It was then discovered, that nearly all of the material carried off mechanically was thrown down near the furnace, and that volatilized was deposited a little farther on. These results having been reached, the difficulty was to keep these deposits where they were, and to prevent them from being carried off by the immense draught in so long a flue. This last obstacle was surmounted by placing transverse sheets of iron in the bottom. When the deposits reached a certain amount on the vertical plates, they dropped off from their own weight, and fell to the bottom, where the transverse plates retained them. Experiments were made as to the distance from the works at which the deposits were made; and at a short distance away was found nearly all the mechanical dust, that from volatilization being a little farther on. There was no material diminution in the draught occasioned by the introduction of the plates. The dust collected so quickly and to such an extent that it became a serious question as to how to remove it. The flues were constructed with manholes at the top, and the dust was in such fine state that the men would be subjected to the danger of suffocation. The problem was solved by setting fire to the flue and burning the dust, which was found in agglomerations easy to remove, and in just the condition to be put into the furnace. The removal was a matter of little difficulty, the manholes having been changed to the sides of the flue. Next arose the question of temperature, and whether or not the lowering of it had any effect on the collection of the dust. It varied from 300° C. near the chimney to 64° C. at some distance from it; and it was found that the degree of heat made little difference. This led to important conclusions; and the substitution was begun, near the chimney, of pasteboard for the iron plates. They answered the purpose just as well, provided they were of sufficient thickness to sustain themselves, and were also much cheaper. After the success of these experiments, the method of cleansing flues by water will probably be abandoned. They have demonstrated the importance of surface over volume, and of the rectangular against the arched flue. It is doubtful if any method can save the whole of the material carried off by mechanical means or volatilization; but it is proved that there can be saved two or three times more than was believed possible.

President Rothwell said that he had visited these works, and had taken much interest in going over them. By the process, a saving of about four per cent is effected over the old way; and Freidenbach charges a royalty of two per cent, or one-half of what he saves. Since the collection of the dust by burning, the pasteboard surfaces had been dispensed with, as they would be destroyed. He had closely observed the iron plates, and found that they were little affected. The first plates used were those which had been discarded from the screens, and had been lying about the yard, being as likely to be acted upon as any; but they showed no signs of deterioration. He had observed the same effect of surface in the collection of arsenic dust in the works at Deloro, although at times he had been obliged to use a fan to secure a draught in long flues. The fan, however, needs frequent cleaning. His observations in regard to the ability of the iron to withstand action by the vapors led him to believe that arsenical chambers might be constructed of the same material with advantage. In regard to the flues at Ems, he had the fault to find, that they were built partly beneath the ground, and were apt to become too warm. He was in favor of building them above ground, and on arched supports, which would give the additional advantage that they could be opened without stopping the run.

Lines of weakness in cylinders.

BY PROF. R. H. RICHARDS OF BOSTON.

It has long been known to boiler-makers and to the users of cylindrical pipes of many kinds, that, when a tube is exposed to internal fluid pressure, the resolution of forces is such that the material of the walls of the tube is exposed to twice the stress in the direction tending to produce longitudinal rupture, that it is in the direction to produce circumferential fracture. By longitudinal fracture is meant the fracture by a rent parallel to the axis; by circumferential fracture, fracture by rents running round the cylinder. In consequence of this, makers of boilers always lay the fibre of their metal around the boiler; and the same is true with the makers of gun-barrels. I have never seen any good and simple illustration of this law until I met it in blowing glass. If a thin bubble of glass be blown out in a spherical form, and then exploded, it will be found that the particles tumble into totally irregular shapes, showing no special direction in the molecular structure of the material. If, now, a bubble of glass be blown out, and so manipulated that it will take a cylindrical form, and then be exploded, it will drop into ribbon-shaped pieces from end to end; and the only parts that will be found to differ from this form will be the two hemispherical ends, which will remain whole, having a fringe of ribbons representing the lines of fracture from the cylinder. The main point of difference between this experiment and the accidental explosion of large boilers appears to be, that in a boiler the shell goes at its weakest point, and once the rent is started it tears the boiler to pieces without much regularity of lines: while in the glass cylinder the walls are so nearly of the same strength that it can hardly be said to have a weakest point; when, therefore, it gets to its limit of strength, and is on the verge of exploding, there is no one place to initiate the explosion, and the glass explodes everywhere. This it does as it should do, by tearing into innumerable ribbons parallel to the axis of the cylinder. If P = the pressure, and D = the diameter of the cylinder, then $\frac{PD}{2}$ = stress tending to longitudinal rupture, and $\frac{PD}{4}$ = stress tending to circumferential rupture.

Professor Richards illustrated his statements by experiments with glass tubing and a blast, with the most complete success.

The shop-treatment of structural steels.

BY MR. A. F. HILL OF NEW YORK.

The speaker urged the importance in the manufacturing-arts of a knowledge of the effects on iron and steel of the various processes to which those metals

are subjected. He took up these processes in their order, and gave the results of a close and careful study into the matter. In the operations of punching and shearing, it is conceded that the effect is to harden the metal to a local extent only; and also that enlargement of the area punched by reaming restores the plate to its original state. But Mr. Hill did not agree with Lieut. Barber, who has announced, as the result of his researches, that the amount of enlargement is a fixed quantity: on the contrary, the amount is dependent upon the carbon percentage and the thickness of the plate. The experiments were made with plates 18 inches wide, ¼, ⅜, and ½ inches in thickness, and .30, .40, and .50% carbon. They were cut in the planer, crosswise to the direction of the fibre; and three pieces from each plate were taken — one from the centre, and one from each end — for examination. The result of the experiments led to the conclusion, that the heavier the plate, or the lower the carbon percentage, the greater the effect of punching. Here is a clear indication of the direction which must be given to this line of investigation; but the conclusion is evident, that a restoration of strength is effected by reaming, although the enlargement is not a fixed quantity. In the cases of sheared and hammered open-hearth steel plates, annealing always restores the plate to its original strength. The capacity for welding is in inverse ratio to the carbon percentage, and the metal must not be heated any higher than is absolutely necessary to effect the weld. Annealing should immediately follow the welding, and the metal must be carried to a higher temperature than when it was last worked. It is a most important operation, and its effect varies directly with the carbon percentage. A metal bath gives unsatisfactory results: the best are obtained by annealing with oil. There is no more danger to be apprehended in annealing steel than in performing the same operation on iron; and nearly all trouble can be traced to poor workmanship.

The strength of American woods.

BY PROF. S. P. SHARPLES OF CAMBRIDGE.

When Gen. Walker was put in charge of the Census department, he was authorized to appoint experts to inquire into special industries. Under this act Prof. Charles S. Sargent of Brookline was appointed to gather statistics in relation to forest industries. Soon after his appointment, in 1869, he became convinced that it would be desirable to make an examination of the fuel-value of the various woods of the United States; and this work was placed in my hands. At the same time I made the suggestion, that, while we had the opportunity, it would be well to test also the strength of these woods: the suggestion was at once adopted, and Professor Sargent immediately set his agents at work in various parts of the country to collect specimens of all the trees growing in their localities; employing, as a rule, botanists who were familiar with the flora of the region in which they were at work. The result was the collection of over 1,300 specimens of wood, comprising more than 400 species and varieties, nearly 100 of which had not before been described as trees growing in the United States. The ash and specific gravity of every specimen in this collection have been determined, in most cases in duplicate: there have been about 2,600 ash and 2,800 specific-gravity determinations. About 325 species were further tested for transverse strength and resistance to crushing. In these series about 1,300 specimens were tested; and, as each was tried in three different ways, it made in all about 3,900 tests. There was a total of about 10,600 tests made on the specimens, many of them being of a series that required at least ten entries on the final report. In addition, seventy tests were made of the carbon and hydrogen in a number of the specimens. These tests have already, so far as the results of the ash and specific gravity of the dry wood are concerned, been published (*Forestry bull.*, No. 32); and a bulletin is soon to be published giving the deflections under various loads.

After the wood had become thoroughly seasoned, it was dressed out into rods 4 centimetres square and 11 decimetres long. These were tested on the Watertown machine, the stick being placed in a perpendicular postion, resting on supports that were exactly one metre apart; the deflection being measured by an ordinary Brown and Sharp's scale graduated to millimetres. The force was applied at the centre of the length, by means of an iron bearing with a diameter of 12.5 millimetres. The loads were applied 50 kilogrammes at a time, and the deflection read on the scale after each weight was added. When the weight equalled 200 kilos, the load was taken off, and the set was measured; the load was again put on, the reading taken at 200 kilos, and again at every 50 kilos until the stick was broken, the breaking-weight being also noted. In entering the test, a record was made of the direction of the fibre in each piece, — i.e., whether the pressure was applied parallel with, or perpendicular to, the annual rings, or quartering them, — but this portion of the test resulted in a failure, the wood seeming to have equal strength in all directions of application of pressure. The stick was also weighed to about half a gramme, from which was calculated the specific gravity. To determine the specific gravity exactly, blocks were taken, carefully dressed out to precisely 11 centimetres in length and 35 millimetres square. They were carefully dried at the temperature of boiling water for a week, and were then measured with a micrometer caliper, and weighed; the specific gravity being calculated from the measurement and weight.

The ash was determined by igniting small blocks, thirty-five millimetres square and a centimetre long, dried in the same way, in a platinum dish in a muffle furnace heated by gas, the heat being applied so carefully that in most cases the ash retained the exact shape of the block: by taking care not to melt the ash, there was avoided a common error resulting from the non-combustion of a portion of the carbon. The ash was perfectly white, except where manganese or iron was present in the wood. It was judged best to report the ash exactly as found, and not to attempt any correction on account of carbon dioxide that might have been lost from the calcic carbonate present. From the results of the specific gravity and ash, the approximate full value was calculated. Count Rumford made experiments from which he came to the conclusion that the same weight of all woods will give the same amount of heat when burned under the same conditions; and Marcus Bull of Philadelphia, in 1826, reached the same result. These are the only attempts known to determine the fuel-value of wood. It is evident, that, if the cellulose in all woods is of equal value, that with the most ash is of the least value for fuel.

In 1848 Liebig made determinations of the carbon and hydrogen in the average composition of European woods; and, singularly enough, all of his experiments were made on hard wood, with one exception, that of fir. I determined the carbon and hydrogen in forty specimens of hard, and twenty-nine specimens of soft, wood. The average results agreed

within one-tenth of one per cent with those of Liebig: in soft woods the hydrogen is almost the same as in hard, but the carbon is from 4 to 5% greater, giving pine a higher fuel-value than hard wood. In these values we find mountain mahogany at the top (on account of its weight); the southern long-leaved pine is next, and at the bottom is poplar; shell-bark hickory is third on the list, these three having 49 to 54% of carbon. The pines are very close together, with over 52% of carbon, while the hard woods average a little under 49% of the average fuel-value by weight for soft wood: burning one kilo gives 4,488 units of heat; hard wood, 3,993.9: by volume, soft, 2,524; hard, 2,776.

In the tests for breaking-strength, the coefficient of elasticity was calculated for all sticks for the first two deflections, i.e., at loads of 50 and 100 kilos, and that at 100 kilos was found in many cases to be larger than that at the lesser load; but the explanation is found in the fact that there is more or less twist in the stick, no matter how carefully it is dressed; and this twist is increased by seasoning. The first load of 50 kilos is just about sufficient to take out the twist, and the second represents the true deflection. The results have shown, that it is by no means necessary to break two sticks to show which is the stronger, provided they are of the same kind of wood: the weak stick will show the largest deflection from the start. The strongest stick found was a piece of common yellow locust, the average of eight or nine specimens giving a breaking-weight of 543 kilos; hickory and southern pine follow closely; ash was found to stand very well up to a certain point, and then it gives way suddenly and without warning, generally shattering badly; California red-wood shatters thoroughly when it breaks, and shows the effect all over, rendering the entire stick worthless; white oak is inferior to several other oaks and to southern pine, the average breaking-weight of 40 specimens being 386 kilos, while the average of 8 specimens of the southern low oak was 528 kilos; 27 specimens of southern pine gave 490 kilos; 36 specimens of the Douglas fir from the Pacific coast, 374 kilos; 6 specimens of western larch, 523 kilos; 13 specimens of white pine, 274 kilos; 11 specimens of beech, 454 kilos; 16 specimens of large nut shell-bark hickory, 464 kilos; 20 specimens of white hickory, 512 kilos; 24 specimens of white ash, 378 kilos; 8 specimens of locust, 543 kilos.

The next series of tests were made on specimens of the same-sized square as before, and 32 centimetres long, compressing them in the direction of their fibres. Nine specimens of locust stood an average weight of 11,206 kilos; 5 specimens of western larch, 10,660 kilos; 35 specimens of white oak, 8,183 kilos; 24 specimens of southern pine, 10,498 kilos. The effect of the pressure on the specimens was very curious. Professor Sharples exhibited a number of specimens thus treated, which showed curious changes under the pressure.

The third series of tests was to find the force necessary to indent the wood at right angles to the grain. These are not yet finished, and I can give only a few general results. The load was noted at every one-hundredth of an inch of indentation, and it was found that the first one-hundredth was the hardest to make. After that the amount of force necessary diminished with each one-hundredth, until, at one-tenth of an inch indentation, it was found that the force required was only twice that at one one-hundredth. The specimens were often destroyed, however, before reaching the greater depth. In closing this paper, I wish to express my public thanks to Col. Laidley for many valuable suggestions made during the work, and to Mr. Howard for his careful aid in bringing the tests to a successful issue.

The eozoic and lower paleozoic in South Wales, and their comparison with their Appalachian analogues.

BY DR. PERSIFOR FRAZER OF PHILADELPHIA.

This paper embodied the observations of the author at St. David's, South Wales, during a visit at the invitation of Prof. Archibald Geikie, director-general of the geological surveys of Great Britain and Ireland, and Mr. B. N. Peach, geologist in charge of the survey of Scotland. The occasion offered a rare opportunity for studying those classic rocks, — the Cambrian; but there were other series of rocks exposed of the greatest interest to the student of Appalachian geology, not only from their points of resemblance to other rocks met with frequently on the Atlantic border of the United States, but from the similar relations which they seemed to bear to the measures in contact with them. At Roch's Castle is an area of Llandeilo flags, resembling what Dr. Frazer has often designated as argillaceous shale; and, in specimens where the decomposition into clay had proceeded very far, there was almost invariably the same disposition to split into prisms of unequally large pairs of parallel planes, no two of which were perpendicular to each other, giving them a remote resemblance to some of the indefinitely numerous varieties of triclinic crystals. Like similar argillaceous shales and slates near the town of York, Penn., and elsewhere in America, the slabs split up into almost any desired degree of thinness. The rock on which the castle is built is a silicious, greenish rock, showing everywhere included crystals of more or less definite outline, and generally of about the size of a buckshot, and containing a whitish or yellowish feldspar. The analogy between this rock and the 'jaspers' of Rogers, of which Dr. T. Sterry Hunt was the first to point out the real character, is striking. In the porphyry of Roch's Castle, the feldspar is oftener yellowish-green than in the orthofelsite porphyries of the South Mountain and of the eastern United States, as there is much of the Welsh orthofelsite which shows flesh-colored feldspar, and much of that of the South Mountain which exhibits green and other colors. The lamination and flaggy structure, when it was apparent, seemed to be entirely due to the arrangement of the cleavage surfaces of numbers of small crystals in the same plane; because a large part of the rocks defied all attempts to define sedimentary structure. Simillar exhibitions of orthofelsite are found in quantity on the eastern slope of the South Mountain in Pennsylvania, from Dilsburg to Monterey. In the latter regions, however, the beds, which are generally in contact with them, have a more chloritic and a more schistose character than the Llandeilo flags. They are marked, too, in America, for a part of their extent, by an horizon of copper ores, of which no trace was observed in South Wales. To the west and north of the beds of intrusive rock which seem to underlie St. David's, and in the harbor of Porth Ceri, there occurs a thick series of greenish, arenaceous beds, showing numerous streaks of chlorite. They are of very great interest, because they are unmistakably hydro-mica schists of light greenish or grayish color, very finely laminated, and resembling the rocks of parts of the South Valley Hill, and of parts of Fulton and Manor townships on the Susquehanna river. Similar schists, which (according to the writer's theory of structure, based on

the study of south-east Pennsylvania) are associated with distinctively chlorite schists, are in contact with the orthofelsite of the South Mountain, in Adams and York counties, Penn. Very similar schists may also be met (though in this case without the presence of orthofelsite) in the Chestnut-hill ore-banks, just north of the town of Columbia, on the lower Susquehanna, and in the Grubb ore-bank, Hellam township, York county. Parts of these rocks in Porth Ceri are very hard, and resemble strikingly some of the greenish grits on the left bank of the Susquehanna, near the Maryland line. These beds on their exposed surfaces become more and more distinct from each other in color as their disintegration proceeds; and it is impossible to overlook the analogies which even these physical features present to the variegated clays, chiefly red and white and pink, which border the bases of the South Mountain, both on the east and in the Cumberland Valley, in Pennsylvania. Another paragenesis, strikingly analogous to that in the South Mountain, is found at Trelethyn, about one mile west by north of St. David's, near one of the largest bands of 'greenstone,' which are colored as such on the geological map. Here is a hard, silicious, greenish rock, with interstitial spaces, filled with milk quartz and epidote, the latter in large excess. This mixed rock, as is the case very frequently in Pennsylvania, forms low ridges in the midst of the softer chloritic schists and orthofelsites, with which it is almost always closely associated. About a mile west by south of St. David's is a hummock, pronounced to be a porphyritic lava, and which greatly resembles the hard green silicious rock, which occurs near Williamson's Point, on the left bank of the lower Susquehanna, near the Maryland line. It is a very important point in the proper understanding of the structure here, and its analogy with the Appalachian phenomena, to determine whether the band of schists which intervene between the two belts of intrusive beds be really Cambrian, or whether they may not correspond with the horizon, to which Dr. Hunt and the writer have supposed that the enormous masses of crystalline schists which stretch from Vermont to Georgia belong. On this point the writer feels unwilling to differ with the able geologists who have assigned their position to the English schists, without attaining, at least, to a portion of their information and experience of this terrain. It is certain that if they be in reality Cambrian, there are great difficulties in the way of considering the orthofelsite beds to the north-west as forming a part of the Huronian. Dr. Frazer studied carefully the structure, with especial reference to the mooted questions connected with the age of the syenitic granite passing through St. David's; and from the appearances of injection of syenitic matter into the elastic beds of the Cambrian shales, regarded the conclusion as unavoidable, that the whole of the syenitic granite mass, of which a part forms the foundation of south-eastern St. David's, is younger than the schists which lie to the south-east of it. If this be so, there is good reason for ascribing the rocks to the north-west of this granite belt to the same age, and of explaining their somewhat modified lithological characters to the alteration produced by this large igneous mass. In summing up his impressions, Dr. Frazer said, —

1. There is a striking analogy between some of the beds which constitute the lower Cambrian in South Wales, and some of the beds which constitute the horizons proximate (both above and below) to the primal of Rogers, or the Potsdam of the New-York geologists. These analogies are not confined to kinds of rocks, but embrace paragenesis, topography, and accessory mineral contents.

2. There is a strking analogy between the orthofelsites, ash-beds, syenitic granites, diabases which here seem to be *younger* than the above, and the same rocks which in the Appalachian region of America seem to be *older* than the primal.

According to the current views of the English geologists, the entire coast-line, which forms the subject of these notes, is minced up by faults of different extents and directions. The writer was not able to convince himself of the existence of all of these faults, nor has he ever seen so many together. At the same time he does not wish to compare on equal terms the experience gained in his short visit with the greater experience of his hosts. Still, he cannot accept the view of so many faults; and mainly on this account he believes the study of the structure in South Wales to be especially important to American geologists, although it seems to support a view of the age of orthofelsites and crystalline rocks in South Wales which the author has always combated, and still combats, as inapplicable to the eastern United States. If, however, there were a network of faults, such as has been stated, the attempts to present a theory of superposition would be attended with the greatest difficulties, and, with no more investigation than he has had opportunity to make, would be entirely fruitless.

The business meeting.

Dr. Thomas M. Drown, the secretary, presented the report of the council, from which it appeared that the receipts of the institute for the year had been $13,169.05, and the expenses $8,140.53; leaving a balance of $5,028.52, which will be invested by the council. The receipts were much higher than in the previous year, the result of a large increase in membership. The tenth volume of the proceedings has been issued, and there will soon be published an index of all the volumes thus far published. Regular meetings were held at Washington and Denver, at which it was gratifying to note the large increase of papers on the mining and treatment of the ores of the precious metals. During the year 10 members have resigned, 25 have been dropped for non-payment of dues, and 8 have died, leaving the present membership at 1,213; of these, 5 are honorary, 50 foreign, and 149 associate members.

The following-named gentlemen were elected officers for the ensuing year: president, Robert W. Hunt, Troy, N.Y.; vice-presidents (for two years), S. F. Emmons, Denver, Col.; W. C. Kerr, Washington, D.C.; S. T. Wellman, Cleveland, O.; managers (for three years), John Birkinbine, Philadelphia, Penn.; Stuart M. Buck, Coalburgh, Kanawha County, W. Va.; E. S. Moffat, Scranton, Penn.; treasurer, Theodore D. Rand, Philadelphia; secretary, Thomas M. Drown, Easton, Penn.

The following papers were read by title only: Gas-producer explosions, by P. Barnes, Elgin, Ill.; Ice mining and storing, by Prof. W. P. Blake, New Haven, Conn.; The mining region about Prescott, Arizona, by John F. Blandy, Prescott; Blast-furnace practice, by Casimir Constable, New York, N.Y.; Notes on the geology of Egypt, with especial reference to the rocks from which the obelisks have been taken, by Dr. Persifor Frazer of Philadelphia, Penn.; Notes on a protected iron hot-blast stove, by Frank Firmstone, Easton, Penn.; The geology of Cape Hatteras and the south Atlantic coast, by Prof. W. C. Kerr, Washington, D.C.; The divining-rod, by Dr. R. W. Raymond, New York, N.Y.; Notes on the Linkenbach

improvements in ore-dressing machinery used at Ems, by R. P. Rothwell, New York, N.Y.; Determination of manganese in spiegel, by G. C. Stone, Newark, N.J.; Gas analysis, by Magnus Troilius, Philadelphia, Penn.; Determination of copper in steel, by Magnus Troilius; History and statistics of the manufacture of coke, by J. D. Weeks, Pittsburg, Penn.; Notes on settling-tanks in silver-mills, by Albert Williams, jun., Washington, D.C.; Water-gas as a fuel, by W. A. Goodyear, New Haven, Conn.; The occurrence of gold in Williamson county, Texas, by Prof. C. A. Schaeffer, Ithaca, N.Y.; On the utility of the method adopted by the Pennsylvania geological survey of the anthracite fields, by B. S. Lyman, Northampton, Mass.; A new form of hydraulic separation for the mills of Lake Superior, by Prof. R. H. Richards, Boston. Mass.; An accident resulting from the use of blast-furnace slag-wool, by Prof. T. Egleston, New York, N.Y.

On motion of Mr. Bayles of New York, a proposed amendment to rule 6, requiring an additional regular meeting during the year, was laid on the table.

On motion of the same gentleman, a suitable vote of thanks was passed to all the gentlemen in Boston who had put the members of the institute under obligations; and, after a formal surrendering of his charge by the retiring president, Mr. Rothwell, the meeting was adjourned.

SIR CHARLES LYELL.[1]

II.

WHEN he returned from this journey, he entered Lincoln's Inn, and began a rather desultory life in the law; and for the five subsequent years his geology had little growth save in his holiday-time. But his eyes, weak from childhood, gave him more trouble as years went on. He found the studies little to his taste, and each vacation drew him more and more strongly to science. In 1823 he became secretary of the geological society. This seems to mark the turning-point in his career; for, though he nominally kept his place as a student for the bar, we find him more and more separated from it in interest. In this year he published his first geological paper.

Perhaps the most interesting part of his letters, at least to the general reader, are those to his father from Paris in 1823. He had an easy entrance to the society of that day, and his clear pictures of many of the scientific men are extremely entertaining. Humboldt, Cuvier, La Place, Broquiert, C. Prévost, Tromsoe, all came under his trenchant pen. Of these Constant Prévost was doubtless his most effective teacher; for his was a spirit of singular insight, and the lines of his thought somewhat resembled those of Lyell's own mind. He has left a scanty record in his writings, but his power is marked in his effect on all who came within his influence.

In 1825, at his father's request, he once again went about his law; was called, and for two years rode circuit with his mind on older, if less musty, things than Jarndyce *vs.* Jarndyce, and the like. This seems to have been the last chance the law had of winning a very keen intelligence to its fields: henceforth he seems to have left it altogether. In 1828 his Principles of geology first took definite shape in his mind, and until his first edition in 1830 he was busied in many journeys after facts for his work. Central France, Italy, Spain, and Germany gave him the most of his field-matter; endless talks with the workers of those countries, for which his considerable knowledge of modern languages well fitted him, did the rest. In these and other journeys, his letters and journals show his ready understanding of men and their societies. He was never a solitary worker: almost every thing comes out in talks and work with others. Even his journals are always addressed to some one. It was an admirable feature of his character, that he was generally out of himself, and even his antagonisms are sympathetic.

His southern journey carried him to Sicily; but it is curious to note that he was delayed in Naples by need of care in avoiding the Tripolitan pirates, by a steamship-journey. It seems strange, that, in the days of emancipation of British slaves, with all the navies of Europe free from larger calls to action, this nest of pirates should have been tolerated.

In 1831 he was appointed professor of geology in King's College, London. His nomination had to be confirmed by a board of bishops and other church-magnates; and his open opposition to the notion of a deluge and a seven-days' creation made it doubtful if he would receive it. At last, in a fine English way, they declared "that they considered some of my doctrines startling enough, but could not find that they were come by otherwise than in a straightforward manner, and logically deducible from the facts; so that, whether the facts were true or otherwise, there was no reason to infer that I had made my theory from any hostile view towards revelation."

His experience as a lecturer in Kings College was not such as to procure him much profit or intellectual gain: so, though he deemed his work successful, he soon abandoned it.

[1] Continued from No. 3.

In 1832 he married Miss Horner, daughter of Leonard Horner, one of the best of the geologists of that day. It was a singularly fortunate union, that lasted for more than forty years.. In all his subsequent work his devoted wife had a large share of sympathy, and often no small part of actual labor; while, by her rare graces of person and intellect, she made his home more of an intellectual centre than any other of its day in England.

In 1834 he made a careful journey through Denmark and Sweden, to study the phenomena of elevation and subsidence exhibited along their shores. His journals in this expedition show in an admirable way the power of combining rapid travel with clear seeing, that so marked his journeys.

We cannot follow the interesting story of his other journeys on the continent. They were all undertaken with the view of fixing the data for his 'Principles.' There are few books covering so wide a field that has been so patiently, so devotedly labored.

In the summer of 1841 Lyell made his first journey in the United States. He was specially induced to the journey by the offer of a course of lectures in the Lowell institute, a prize that has tempted so many distinguished men to this country. When the history of science in America comes to be written, this institution will have to be credited with much of the best help that has been given to its advancement. Thirteen months of assiduous travel carried him over a large part of the United States and Canada.[1] It is to be regretted that only half a dozen letters touch upon this interesting journey, for they show a singularly clear and just impression of the social conditions of that time. It is curious to notice, that, in the first letter, he indicates his half belief that the negroes should be distinguished as a distinct species from the Caucasian. In these letters as well as in the record of his travels, in the First visit to the United States, he shows always a sense of hopefulness for our future, and delight in our essential, though rather material, success, that is in wide contrast with the other travellers of that day. In the letter to George Ticknor, Esq., written just after his return to Great Britain, he shows a capital power of discrimination between the good and the evil of our land at that time. These letters to Mr. Ticknor are among the most charming in the second volume, showing him at his best; for his correspondent had the admirable power of putting all men to their best in their intercourse with him.

In 1845 we find him, with Faraday, a member of a commission on colliery-explosions. His picture of Faraday is very interesting, and shows a new side of that remarkable character.

In 1845 he again visited the United States, remaining nine months. In this journey he saw the south once again, and found himself much more content with the institution of slavery; for he now saw how much it had done for the people not born in its toils. Unhappily, his letters are not sufficiently numerous to follow him on his geological work: the reader may, however, do this in his Second visit to the United States.[1] He made two other visits to this country, both much briefer than his earlier journeys. One of them was for a general and very successful series of lectures before the Lowell institute; and the last as commissioner to the "world's fair" of New York, of 1853. In 1854 he visited Madeira, the last, and on some accounts one of the most important, of his many journeys; for it completed his admirable studies of volcanoes. From this time on, his work was mainly given to the successive editions of his Manual and Principles, and the Antiquity of man, no memoirs of importance appearing from his pen. To this task of re-editing he added that of adviser to all the rising geologists of England, we may say of the world. His house, at 15 Harley Street, famous in an earlier day as the home of Sir Arthur Wellesley, became the centre of a brilliant society; and in its kindly offices his beautiful life went slowly to its end. In the spring of 1873 his wife died. He struggled bravely against the burden of time and care for nearly two years, until, on Feb. 22, 1875, he passed away; leaving one of the purest memories that was ever gathered in a life of nearly fourscore years, and a place among the students of the earth's structure that can never be filled.

It remains to speak of the work of the editor. This seems remarkably well done. A small and well-considered thread of narrative binds the scattered letters and fragmentary journals into a whole. We see the man, unconsciously pictured by himself, from his youth to his end. An excellent list of his contributions to science accompanies the work.

It is to be regretted that the letters are not twice as numerous. There are none to C. Prévost or to Deshayes, and scarcely any to

[1] Travels in North America, with geological observations. 2 vol., London, 1845.

[1] A second visit to the United States of North America. 2 vol., London, 1849.

his other continental correspondents. There are none to Agassiz, with whom he was in correspondence. It is to be hoped that in another edition some of these omissions may be supplied. They afford the best keys to the history of scientific opinions in the vigorous years of this century that have yet been given to us. Unfortunately, the most instructive part of his intercourse, that with his companions in his own society, did not, of course, find this form of expression; but there is enough in these two volumes to show the peculiar charm of his character and to explain his wide influence. It has been the good fortune of the writer to use the Principles for nearly twenty years as a 'compend' for lectures to a class of university students. The beauty of their spirit has served to enchain near a thousand students in the study of the science, while the recollection of instructive days with their author has freshened the labor of teaching. His was a pure, strong spirit, well pictured in his own charming account of the spirit of man, as free: —

"Ire per omnes
Terrasque tractusque maris coelumque profundum."

ASTRONOMICAL LITERATURE.

Bibliographie générale de l'astronomie, ou Catalogue méthodique des ouvrages, des mémoires et des observations astronomiques, publiés depuis l'origine de l'imprimerie jusqu'en 1880. Par J. C. HOUZEAU et A. LANCASTER. Tome Second: *Mémoires et notices insérés dans les collections académiques et les revues.* 1er fascicule, déc., 1880; 2e fasc., mars, 1881; 3e fasc., juin, 1881; 4e fasc., avril, 1882. Introduction, (?), 1882 [the whole volume consisting of 2,225 col., or about 1,100 p.]. l. 8°.

BEFORE the publication of this work, there were three general scientific bibliographies of importance to astronomers, — Reuss' Repertorium, the Royal society's Catalogue of scientific papers, and Poggendorff's Handwörterbuch. The first two related only to memoirs, and not to separate books: the third included the most important books and memoirs of each author. Reuss (vol. v., Astronomy) was very far from complete to 1800; the Royal society's catalogue omitted whole series of journals from its plan, so that the work of MM. Houzeau and Lancaster has over forty per cent more entries for the corresponding period. Poggendorff's excellent work will always be useful. Of special astronomical bibliographies there are several; the two most important being Lalande's and the Catalogus librorum of the Pulkova observatory. These will always have a peculiar value; but for practical purposes these and almost all other special bibliographies will be superseded as soon as M. Houzeau's work is completed.

Vol. ii. (the only one yet published) consists of references to all memoirs, etc., in the transactions of learned societies and in journals. These are classified by subjects, — somewhat minutely, as may be seen by the following extract, which contains all the divisions of celestial mechanics: —

SECTION V. — *Mécanique céleste.*

The authors have added to very many of the references a brief note of the contents of the paper. These notes will often appear too brief and inexact to the specialist in each department (who will, however, be grateful for them when he is looking up some unfamiliar subject), and it would not be hard to find some misconceptions recorded in them; but they double the value of the book to the working astronomer, and are priceless to the pupil.

The best indication of the way in which the work is done is to be had by quoting one or two extracts at random: —

"BAILY (F.): On a remarkable phenomenon that occurs in total and annular eclipses of the sun. Londres, MAS., X, 1838, 1. [etc.] Les grains blancs, le peigne et la goutte noire."

"WURM: Merkur. Ba J, Sup, II, 1795, 4. Diam. apparent."

"SECCHI, A. Saturne, Le soleil, [etc.] p. 395, avec 1 dessin, p. 255."

It may be noted here, that there are only some score of drawings of Saturn referred to: the list might be trebled easily. The registers of authors, etc., are most full and valuable; and every aid is provided for a quick consultation of the authorities.

It has been considered necessary to limit the scope of the work to astronomy proper, and sometimes this limitation is quite inconvenient. For example: measures or computations of the compression of the earth deter-

mined by geodetic methods have been excluded (and also measures of arcs of the meridian, length of seconds-pendulum, etc.), while only those determinations which are astronomical in their essence are given.

In some cases this produces strange lacks, yet it is probable that no better plan could have been chosen. Even in bibliography it is necessary to stop somewhere.

The introduction, of eighty-nine pages, is the most generally interesting portion of the work, as the statistics of astronomical bibliography (only of memoirs, etc., not books, be it remembered) are here discussed.

Some thirty thousand original articles are referred to in this volume. Leaving out the unimportant ones, the rest are divided as to language as follows: —

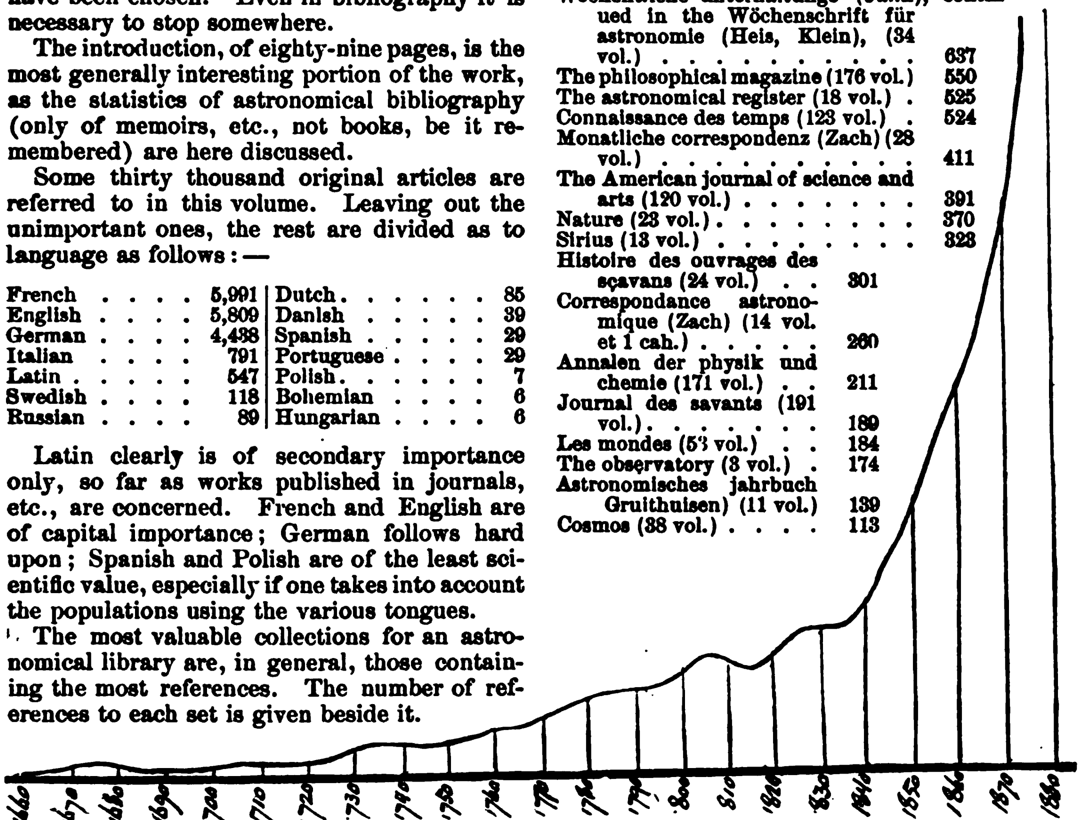
French	5,991	Dutch	85
English	5,809	Danish	39
German	4,438	Spanish	29
Italian	791	Portuguese	29
Latin	547	Polish	7
Swedish	118	Bohemian	6
Russian	89	Hungarian	6

Latin clearly is of secondary importance only, so far as works published in journals, etc., are concerned. French and English are of capital importance; German follows hard upon; Spanish and Polish are of the least scientific value, especially if one takes into account the populations using the various tongues.

The most valuable collections for an astronomical library are, in general, those containing the most references. The number of references to each set is given beside it.

Annuals, reviews, and journals, which have furnished more than a hundred articles, follow in the order of importance: —

Astronomische nachrichten (99 vol.)	1,918
Berliner astronomisches jahrbuch (107 vol.)	896
English mechanic and world of science (32 vol.)	841
Wöchentliche unterhaltunge (Jahn), continued in the Wöchenschrift für astronomie (Heis, Klein), (34 vol.)	637
The philosophical magazine (176 vol.)	550
The astronomical register (18 vol.)	525
Connaissance des temps (123 vol.)	524
Monatliche correspondenz (Zach) (28 vol.)	411
The American journal of science and arts (120 vol.)	391
Nature (23 vol.)	370
Sirius (13 vol.)	323
Histoire des ouvrages des sçavans (24 vol.)	301
Correspondance astronomique (Zach) (14 vol. et 1 cah.)	260
Annalen der physik und chemie (171 vol.)	211
Journal des savants (191 vol.)	189
Les mondes (53 vol.)	184
The observatory (3 vol.)	174
Astronomisches jahrbuch Gruithuisen) (11 vol.)	139
Cosmos (38 vol.)	113



CURVE OF FREQUENCY OF ASTRONOMICAL PUBLICATIONS, A.D. 1660-1880.

Monthly notices of the royal astronomical society (40 vol.)	1,573
Comptes-rendus de l'académie des sciences de Paris (93 vol.)	1,481
Histoire de l'académie des sciences de Paris (107 vol.)	779
Philosophical transactions of the royal society of London (169 vol.)	551
Memoirs of the royal astronomical society (45 vol.)	309
Proceedings of the royal society of London (28 vol.)	222
Reports of the British association for the advancement of science (47 vol.)	203
The selenographical journal (3 vol.) Vierteljahrsschrift der astronomischen gesellschaft (14 vol.)	147
Bulletins de l'académie des sciences de Belgique (72 vol.)	139
Bibliographie astronomique, Lalande (1 vol.)	119

The number of articles published per decade from 1601 to 1880 is as follows: —

1601–1610	5	1741–1750	241
1611–1620	4	1751–1760	311
1621–1630	4	1761–1770	372
1631–1640	6	1771–1780	557
1641–1650	15	1781–1790	669
1651–1660	17	1791–1800	712
1661–1670	72	1801–1810	979
1671–1680	128	1811–1820	865
1681–1690	71	1821–1830	1,188
1691–1700	74	1831–1840	1,234
1701–1710	115	1841–1850	1,782
1711–1720	108	1851–1860	2,712
1721–1730	139	1861–1870	3,838
1731–1740	255	1871–1880	6,372

This is a condensation of a more extended table (by years), which is better exhibited in

the accompanying figure of the curve of frequency of astronomical publications. Notice in the curve the dates of the discovery of Neptune (1846), of the transit of Venus (1874), of the French Revolution (1794), of the wars of Napoleon (1815), etc.

The number of authors per century is: —

1601–1700	88
1701–1800	571
1801–1880	2,901

The number of articles per century is: —

1601–1700	396
1701–1800	3,479
1801–1880	18,970

The proportion of articles per author is: —

1600–1699	4.5 articles per author.
1700–1799	6.1 " " "
1800–1880	6.6 " " "

The following list of authors who have furnished more than a hundred articles conveys its own lessons: —

	Articles.		Per year.
1. Secchi	360,	1846–1878	10.9
2. Lalande	299,	1743–1807	4.6
3. Zach, F. X. de	252,	1785–1832	5.3
4. Bessel	243,	1805–1846	5.8
5. Flammarion	210,	1863–1881	11.1
6. Birt	207,	1857–1881	8.3
7. Proctor	178,	1865–1881	10.5
8. Gruithuisen	177,	1817–1850	5.2
9. Faye	177,	1846–1881	4.9
10. Mädler	169,	1831–1870	4.2
11. Le Verrier	164,	1839–1877	4.2
12. Cassini, J. D.	143,	1664–1709	3.1
13. Wolf, R.	142,	1844–1881	3.7
14. Laplace	135,	1772–1827	2.4
15. Airy	134,	1826–1881	2.4
16. Bode	124,	1775–1826	2.4
17. Lockyer	120,	1864–1881	6.7
18. Encke	117,	1819–1865	2.5
19. Arago	110,	1814–1853	2.8
20. Delambre	107,	1783–1822	2.7
21. Heis	106,	1847–1877	3.4
22. Euler, L.	105,	1735–1783	2.1
23. Hansen	105,	1824–1874	2.1

It will be evident that this book is indispensable to every astronomical library; and the smaller the library, the more important such a work becomes. Much of the material of this work has been incorporated in another work by M. Houzeau: Vade-mecum de l'astronome, Brussels, 1882; 28+1,144 p. 8vo.

For each of these works, astronomy and every astronomer owes a debt of gratitude.

EDWARD S. HOLDEN.

THE FORMATION OF COAL.

Mémoire sur la formation de la houille; par Grand'-Eury. Paris, *Dunod.* 1882. 196 p., 4 pl. 8°.

THIS work of Grand'Eury, reprinted from the *Annales des mines* for 1882, exposes upon the origin of the coal such an array of facts, considerations, hypothetical subjects of inquiries, and assertions based upon long and careful researches, and these are scattered in so many chapters, that the only possible way to give an idea of the scope of the work is to quote the titles of the essential divisions.

The first part considers the botany and stratigraphy of the carboniferous formations, in seven chapters: 1°. State of disintegration of the plants; 2°. Distribution of the remains of fossil plants in the rocks; 3°. Structure of coal, and its organic composition; 4°. Trunks and stipes *in situ;* fossil forests and carboniferous forests, their relation to coal-beds; topographical circumstances; 5°. Examination of the fossil stems and of the lignite, and their comparison with coal-beds; 6°. Peat-bogs and other deposits of vegetable matters; 7°. Critical review of the divers theories on the formation of coal.

The second part treats of the physical and chemical characters as follows: 1°. State of the vegetable remains in coal; 2°. Physical properties of coal; 3°. Chemical composition; 4°. Comparison of the characters of fossil wood, lignite, and peat; 5°. Circumstances which have fostered the transformation of coal; 6°. Conclusions and *résumé.*

Each of the above chapters is subdivided into a number of sections, ninety in all, each with a title, and a short exposition of the contents. From his long researches in the coal-fields of Europe, the author comes to the conclusion that the matter composing the coal is of vegetable origin, derived from plants grown *in situ*, rapidly decomposed under atmospheric influence, more slowly transformed by maceration, and later washed out by torrential floods of rain, transported and deposited in depressions or basins surrounded by swampy forests, — the coal, in his opinion, being the result of stratification like the rocks. Besides the many other objections which could be made against this theory (a theory suggested to the author by the small areal surface occupied by the coal-deposits of France) we may mention the wide extent of the American coal-fields, and the continuity of some of the beds which cover areas of many hundred square miles, as sufficient to contradict the assertions of the distinguished author. Nevertheless, the book is very instructive as exposing a mass of facts concerning the divers phases of a formation, which, though often considered by science, are still, some of them at least, unexplained.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

The great comet of 1882. — Mr. R. H. Tucker, jun., of the Dudley observatory, gave a brief account of his observations, beginning Sept. 29, and followed during October and November by a series of twenty complete comparisons with stars, the accurate places of which are to be obtained by the meridian circle of the observatory. Positions of the comet depending upon star places from catalogues of old observations have been, however, used for orbit work; five made here having been telegraphed by request to the Cambridge observatory and used for the 'normal place orbit,' the best that has appeared. Mr. Tucker showed the similarity of the elements of this orbit to those of others, notably those of 1843 and 1880. The best theoretic orbits, however, show that this cannot be a comet of short period, and consequently not a return of either of those above referred to. He also gave the results of measurements of the head and tail made at the observatory, and described the changes noted in the structure of the former; also some of the results of spectroscopic work elsewhere, showing, among other things, distinct sodium bands in the spectrum.

In answer to questions raised in the discussion, Mr. Tucker gave the perihelion distance of the comet as probably within 500,000 miles; and stated that the form of the orbit is probably an ellipse, but very nearly a parabola; also, that the comet is evidently to a great degree self-luminous; and, further, that the comet's motion was not affected by its near approach to the sun, — unless, perhaps, retarded by a solar atmosphere, — for the obvious reason that both the comet's motion and the form of its orbit were originally due to the sun's attraction. — (*Albany inst.; meeting* Jan. 30.) [260

ENGINEERING.

Transverse strength of wooden beams. — Prof. Gaetano Lanza, of the Massachusetts institute of technology, described the testing-machine, and exhibited its mode of operation by breaking a 6×12 inch spruce beam, eighteen feet span, loaded at the middle. He also reviewed the results of some of his tests, as published in the Journal of the Franklin institute for February, 1883, and deduced a modulus of rupture of from 3,000 to 4,000 pounds per square inch in case of spruce, depending on the quality of the lumber; also, an average modulus of elasticity of 1,293,732. The results of four tests of *yellow pine* were also given with a time test on a 4×12 inch yellow pine beam, twenty feet long and loaded at the middle; also, the author's deductions from this time test as to the value of the factor of safety to be employed until a large number of tests shall determine the true value of the modulus of elasticity. — (*Bost. soc. civ. eng.; meeting* Jan. 21.) [261

CHEMISTRY.

Complex inorganic acids. — Professor Gibbs stated, that, in the further generalization of the results of his investigation of the complex inorganic acids, he had obtained glycero-phospho-tungstate and glycero-phospho-molybdate of barium as well-defined and beautifully crystalline salts; also dimethyl-arsino-tungstate and dimethyl-arsino-molybdate of sodium in colorless, very slightly soluble crystals. He directed attention to the fact that hypo-phospho-molybdate of ammonium, which he had at first expressed empirically as, —

$$24\,MoO_2 . 6\,PO_2 . 6\,(NH_4)_2O + 7\,aq, —$$

should be written rationally, with 2 additional molecules of hydrogen, either as —

$$8\,MoO_3 . 2\,\{H_2 . PO . OH\}\,2\,(NH_4)_2O + 2\,aq;$$

or as —

$$8\,MoO_3\,2\,\{H_2 . PO . (ONH_4)\} . (NH_4)_2O + 3\,aq.$$

In like manner the phosphoroso-molybdate of ammonium described by him with the empirical formula, —

$$24\,MoO_3 . 2\,P_2O_3 . 5\,(NH_4)_2O + 20\,aq, —$$

should be written either —

$$24\,MoO_3 . 4\,\{H . PO . (OH)_2\}\,5\,(NH_4)_2O + 14\,aq;$$

or —

$$24\,MoO_3 . 4\,\{H . PO . (ONH_4)_2\}\,(NH_4)_2O + 18\,aq;$$

though of course in each case a partial replacement of (OH) by (ONH_4) within the molecule of $2\,\{H_2 . PO . OH\}$ or $4\,\{H . PO . (OH)_2\}$ is equally possible. The hypo-phospho-molybdates should be called *di-hydryl-phosphino-molybdates*, and the phosphoroso-molybdates *hydryl-phosphino-molybdates*. The dimethyl-arsino-tungstates and dimethyl-arsino-molybdates evidently belong to the first series. Prof. Gibbs further stated, that he had found that other modifications of phosphoric acid were capable of forming complex acids with tungstic and molybdic oxides, and that he had obtained very well characterized pyro-phospho-tungstates and meta-phospho-tungstates, as well as the corresponding molybdenum compounds. The molybdico-tungstates, the discovery of which he had announced at the last meeting of the club, and which contained molybdic dioxide (MoO_2), formed a particularly well defined and beautifully crystallized series. In conclusion, he described in detail the very remarkable relations of vanadic pentoxide (V_2O_5) to phosphoric and arsenic pentoxides, and gave an account of the phospho-vanadates and arsenio-vanadates considered as complex acids of an entirely new class. — (*Harvard chem. club; meeting* Jan. 23.) [262

AGRICULTURE.

A new nitrate ferment. — The reduction, as well as the formation, of nitrates in the soil is now proved to take place under the influence of living organisms. A year and a half ago, while experimenting with infusions of the roots of plants in water, Dr. A. Springer noticed a copious evolution of nitric oxide proceeding from those rich in nitrates; this seemed to arise from the action of small organisms upon the roots. He then made separate infusions of the roots, stems, and leaves of tobacco, and divided each set into four parts. Fermentation was excited in these by yeast, by urine, by the 'spontaneous method,' and by the newly discovered ferment. Among the ferments developed was one which appears to have the property of dissociating the nitrates of the soil. This may be classed among the Anaerobies, but oxygen does not stun it. The ferment obtained from chalk by Bechamp (Bull. soc. chim. [2] vi, 484) is probably the same. Further experiments are in progress. — (*Ohio mech. inst.; sect. chem. phys.; meeting* Jan. 18.) [263

Manuring vineyards. — In experiments in three Rhenish vineyards, Wagner finds that manuring with soluble phosphoric acid (100 kg. per hectare) produced in one case no increase, in another case a considerable and profitable increase, and in the third case an undeniable decrease, of the crop. Addition of potash and nitrogen produced no, or only a very slight, increase. The soil was already rich. No explanation of the unfavorable effect of the phosphoric acid was evident; but experiments on other plants by the same experimenter have shown that excess of phosphoric

acid, especially in a dry soil, may hasten the death of the organs of nutrition. — (*Landw. versuchs-stationen*, xxviii. 123.) H. P. A. [264

Determination of humus in the soil. — Loges finds that the results obtained by oxidation with chromic acid and absorption of the CO_2 are too low. From 64 to 96 per cent of the total amount of carbon was obtained, the remainder being incompletely oxidized, and escaping partly as volatile products. The loss on ignition was hardly sufficient for even an approximate estimate of the amount of organic matter present. — (*Landw. versuchs-stationen*, xxviii. 229.) H. P. A. [265

GEOLOGY.

The formation of coal. — This memoir by M. Gaston de Saporta, written in a clear, elegant, and really admirable style, reviews and eulogizes without critical observations the essential point of the theory of Grand'Eury, mentioned in two other places in this issue. The first part of the review is a historical record of the researches made on the formation of coal since the first author who tried to ascertain its nature and composition, or from Antoine Jussieu to Buffon in France; then to the Germans Blumenbach, Schlotheim, Sternberg especially, and after him to Brongniart, who in 1837 was the first to consider the origin of coal as related to that of peat. The author of the memoir sees in the lignite deposits of Fuveau, near the Bouches du Rhone, analogy of formation with that of the paleozoic coal-beds, as it has been exposed by Grand'Eury. — (*Rev. des deux mondes*, Dec. 1, 1882.) L. L. [266

METEOROLOGY.

Indian meteorology. — The studies of A. N. Pearson, the acting meteorological reporter for western India, of the meteorological conditions in 1881, confirm the results of previous observations, that there are abnormal movements of atmospheric pressure which affect a very wide area, and which are not simultaneous in all parts of that area, but travel from west to east. The barometric readings made at Zanzibar, when compared with those of the Bombay presidency, show the possibility of predicting the general nature of the seasons in western India some months beforehand; but there are irregularities in these abnormal movements, the cause of which must be discovered before the nature of the seasons can be foretold with certainty. These observations of Mr. Pearson are to be welcomed, since they are in the direction of a legitimate forecasting of the seasons on a scientific basis. — (*Brief sketch meteor. Bombay pres.*, 1881.) W. U. [267

ZOÖLOGY.

Protozoa.

Preservation of Protozoa. — Henri Blanc recommends preserving protozoa with a mixture of 100 pts. concentrated solution of picric acid, 2 pts. sulphuric acid, and 600 pts. distilled water, with one drop of 1% acetic acid for every five centimetres of the mixture. For coloring use 5 grms. of safran dissolved in 15 grms. absolute alcohol, which is allowed to stand for a few days, and then be filtered. — (*Zool. anz.*, vi. 22.) C. S. M. [268

Criticism of Künstler's theory of Protozoa. — Künstler, in a recent thesis, attempted to overthrow the cell-doctrine in its application to Protozoa, and reported a number of surprising discoveries. Bütschli criticises him severely, and maintains that one form which he described as new, under the name of Künckelia gyrans, is in reality a Cercaria and not a Protozoan: Bütschli suggests that so gross an error ought to invalidate the whole article. — (*Zool. anzeig.*, no. 128.) C. S. M. [269

Interesting new ciliate infusorian. — "Mr. F. W. Phillips describes a new genus and species (*Journ. Linn. soc., zoöl.*, xvi. 476.) under the name of Calyptotricha pleuronemoides, found attached to Myriophyllum. The animals are furnished with a remarkable transparent hyaline ovate lorica, opening teat-like at both ends, and a vibratory membranous hood or velum almost equal to the ventral length. The anterior end of the body is protrusible from the lorica. Their length is .001 inch; and the non-vibratile setose body-cilia are about two-thirds of this length, with shorter, stronger vibratile cilia at the entrance of the velum." — (*Journ. roy. micr. soc. Lond.*, ii. 799.) C. S. M. [270

Merejkowsky's Suctociliata. — Merejkowsky found in the gulf of Naples an infusorian having both cilia and suckers, and therefore intermediate between the Ciliata and Acineta. The animal, which is very common, resembles a Halteria: the anterior part of the body has a conical neck, around the base of which is a crown of three circles of seven or eight stiff cilia; the mouth is at the front of the neck, and is surrounded by four conically placed suckers, which cannot, however, be observed when the neck is retracted: hence they were overlooked by Cohn, who has given a superficial description of the animal under the name of Acarella siro. Merejkowsky regards this as a new type of great phylogenetic importance. — (*Comptes rend.*, xcv. 1232.) [271

Maupas criticises this publication. Stein had long ago described an intermediate type, Actiorobolus. Merejkowsky's species has been long known as Halteria pulex (Clap. Lach.), H. tennicollis (Fresenius). The supposed suckers have been figured by Claparède and Lachmann, and described besides by Fresenius; and there is no proof that they are homologous with the suckers of Acineta, but they are organs of attachment by which the animal anchors itself. Maupas reiterates his opinion, that the ancestral affinities of the Acinata are to be sought with the Heliozoa, rather than the Ciliata. — (*Comptes rend.*, xcv. 1381.) C. S. M. [272

Theory of the conjugation of Infusoria. — Bütschli criticises the assertions made by Balbiani, in his lectures as reported in the *Journal de micrographie*, concerning the reproduction of Infusoria. He gives brief summaries of Balbiani's views as advanced in 1861, and of his own. The brief and clear *résumés* render the article valuable for reference, but the author's purpose is to correct certain misrepresentations which Balbiani has permitted to appear in his lectures. — (*Zool. anz.*, vi. 10.) C. S. M. [273

VERTEBRATES.

Localization of functions in the cerebral cortex. — From the results of experiments on dogs, Bochfontaine concludes that Flourens was correct in ascribing vicarious functions to the cerebral convolutions. At one time electrical stimulation of a particular surface area *a* may, for example, be followed by secretion of the sub-maxillary gland or by some definite movement of a limb, while the same stimulus applied to other regions of the cerebral surface has no such consequences. In half an hour or forty-five minutes the region *a* will, however, cease to react to stimuli, while some other area *b*, previously inexcitable, becomes irritable, and its stimulation is followed by the same phenomena as previously the stimulation of *a*. The author suggests that the gray rind is itself not capable of electrical excitation, and that the

result is always due to direct stimulation of subjacent medullated nerve-fibres. A bundle of such fibres, all with the same peripheral connection, may subdivide in the brain, and end in three or four different regions of its surface: to this assumption he adds the further gratuitous one, that only one cerebral division of the nerve-fibre bundle is excitable at any one moment. — (*Arch. physiol. norm. path.* (3), i. 1883, 28.) H. N. M. [274

Properties of saliva. — Why has human saliva the power of saccharifying starch-paste, while that of many animals, even herbivorous as the horse, has not? Under the prevalence of atmospheric-germ theories, some have lately been inclined to believe that human saliva owes its power merely to the fact that it is a good medium for the development of amylolytic bacterial organisms. Béchamp, as a result of somewhat extended observations, concludes: 1°, that the starch-saccharifying activity of human saliva is not due to chance germs which have entered the mouth from the atmosphere; but 2°, is due to a special ferment more active than diastase; and 3°, produced by the action on the pure secreted saliva of specific microscopic organisms living in the salivary glands and in the mouth-cavity of man. The pure parotid saliva of horse or dog does not convert starch-paste into copper-oxide-reducing substances, nor does it acquire this power when exposed to the air, or when gently warmed along with scrapings from the tongues of those animals; but when scrapings from the inside of the human mouth are added to it, it soon becomes a very efficacious agent for the saccharification of starch. — (*Arch. physiol. norm. path.* (3), i. 1883, 47.) H. N. M. [275

Fish.

A new genus of Lepidopodinae. — In 1878 Mr. F. E. Clarke described (*Trans. New Zeal. inst.*, v. 294) a new lepidopodine as Lepidopus elongatus. Mr. Clarke established the species for 'eight or ten examples, all taken at Hokitika, on the South Island of the New-Zealand group' (lat. S. 43°, long. E. 171°). Singularly enough the new species has turned up, almost at the antipodes, on the Great Bank of Newfoundland; a specimen having been obtained from the stomach of a halibut, caught at a depth of eighty fathoms. The species has been re-described by Goode and Bean, and referred to a peculiar genus with the name Benthodesmus elongatus. It differs from Lepidopus by the more slender body, more numerous dorsal spines, etc. — (*Proc. U. S. nat. mus.*, iv. 379.) T. G. [276

Schedophilus medusophagus in Ireland. — A specimen of this interesting fish, 9¼ inches long, was caught in August, 1878, in a salmon-net at Portrush, County Antrim, and has been recently described and figured by Dr. Günther. The illustration differs very much from those previously published, but bears internal evidence of being much more correct than the others. No remarks have been made by Dr. Günther as to the affinities of the species, and hence it is presumable that he still adheres to his classification of the fish in the family Coryphaenidae. It, however, is evidently a stromateid, and closely related to the rudder-fish (Lirus or Palinurichthys perciformis) of the United States, and like that species is a pelagic form which merely visits the coast. — (*Trans. zoöl. soc. London*, xi. 223, pl.) T. G. [277

Delolepis, a new genus of Cryptacanthidae. — The family of Cryptacanthidae has been long confined to a single genus of two species, or sub-species, peculiar to the New-England fauna, but has recently received a notable addition from the west coast of America. The new species has been detected at Port Wrangel, Alaska, as well as at Kingcombe Inlet, Brit. Col., and differs from the typical species by the development of small cycloid imbricated scales. It has been, therefore, distinguished by Dr. T. Bean as a special generic form, under the name Delolepis virgatus. — (*Proc. U.S. nat. mus.*, iv. 465.) T. G. [278

The Anguilla Kieneri of Günther a Lycodes. — Some years ago ichthyologists were startled by the announcement, from Dr. Günther, that 'the young of Anguilla Kieneri, a species hitherto known from the Mediterranean only,' had been found in the North Atlantic at a depth of a hundred and eighty fathoms; and the specimen in question, *inter alia*, was even adduced in evidence 'that fishes hitherto known from more southern latitudes occur in the north Atlantic at a moderate depth (of between eighty and two hundred fathoms).' The fish thus identified has been re-examined by Surgeon Francis Day, and proves to have ventral fins, and not to belong to the same order as the A. Kieneri: it is, in fact, a species of Lycodes, a characteristic type of the northern waters of moderate depths. — (*Proc. zoöl. soc. Lond.*, 1882, 536.) T. G. [279

Birds.

Albinos. — Mr. Charles A. Townsend called attention to a large number of albino specimens from the ornithological collection of the academy, among which the magpie and merganser had not, as far as he was aware, been before observed in this condition. The collection also included a kingbird, red-tailed hawk, chewink, and red-head duck, all of rare occurrence in the albino state. Melanism had only been observed by him in one specimen of a meadow-lark. — (*Acad. nat. sc. Philad.; meeting* Feb. 13.) [280

ANTHROPOLOGY.

Laughter in lower animals. — In a discussion upon specimens of the orang and chimpanzee, M. Dally remarks that young negroes are gay and frolicsome, but no one has ever seen a negro aged over thirty or forty years show gayety, — in which respect there is a strong resemblance between them and the anthropoids, the latter being frolicsome in youth and morose when adult. This statement is startling to persons familiar with the negroes in America, who at all ages are noticeably light-hearted and merry. Nothing is more common here than the broad grin and loud laughter of a white-headed and coal-black negro. Indeed, the contrast between the inveterate and irrational merriment of the blacks, and the prevailing anxious, if not sad, expression of our adult white population, would present an argument regarding their relative inferiority in precise opposition to that urged by M. Dally. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [281

Hero myths. — Dr. Daniel G. Brinton presents another volume entitled "American hero-worship: a study in the native religions of the western continent." In it he discusses certain myths of the Algonkian, Iroquoisian, Aztekan, Mayan, andother linguistic families of North America.

The purpose of this volume is, "to show that their chief god was not identified with any objective natural process, but was humane in nature, benignant in character, loved rather than feared, and that his worship carried with it the germs of the development of benevolent emotions and sound ethical principles." This he attempts to do by giving interpretations of the myths in question. The gods are considered as anthropomorphic heroes of light and darkness, and the cardinal points of the compass.

The work is rather an elaborate study of some well-known but badly recorded myths. The myths discovered among savage and barbaric peoples, and told by untrained anthropologists, have as little value for the science of anthropology as the stories told by unscientific travellers concerning wonderful animals have for zoölogy. In every Indian village of North America, civilized or uncivilized, the myths of the ancient days are yet told; and the science of North-American mythology cannot be given to the world until thousands of myths now current are collected by trained men. — J. W. P. [282

Mortuary customs. — Several curious survivals in different departments of France noted; among them, beehives put in mourning with black cloth, on the death of the proprietor, to prevent flight of the bees after the soul. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [283

Cranial deformation. — In the collection of crania by M. Marche, from the Philippine islands, a large proportion exhibited an occipito-frontal compression, described by M. Topinard to be nearly identical with the results of the cranial compression of the Peruvians and Chinooks. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [284

Brain-weight tables from Cochin China. — A contribution of M. Neïs is described by M. Topinard as the most important yet received regarding the cranial capacity of the 'yellow race,' showing a near approach to Europeans, and marked separation from negroes, in this respect. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [285

The nur-aghes of Sardinia. — Dr. d'Hercourt described the ancient stone-works, or nur-aghes, of Sardinia, and contended that the object of their construction was for places of refuge for man and beast against sudden attack, and also to serve as signal-stations. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [286

Races in Cochin China. — M. de Claubry presents the characteristics of the Malabars, Malays, Cambodians, Chinese, and Anamites, the last named being the most interesting. — (*Bull. soc. anthrop. Paris*, April–July, 1882.) J. W. P. [287

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Bureau of weights and measures.

Distribution of standards. — Under the provisions of a joint resolution of the two houses of congress, approved March 3, 1881, there are now preparing in the Bureau of weights and measures, at Washington, sets of customary English standards, for distribution to the governors of the various states, for the use of the agricultural colleges throughout the country. One set is to be sent to each state. In cases where there are two or more agricultural colleges in one state, the question of assignment is left with the governor. Each set consists of a yard-scale divided to tenths of inches; weights, twenty-six in number, ranging from twenty-five pounds to one grain; liquid measures from a gallon to a pint; and dry measures from a half-bushel to a quart. These are closely adjusted to the standards, and with each set will be sent a table of the very small residual errors shown to exist by the final comparisons. The adjustment of these weights and measures is now so nearly completed that notifications have been sent to the governors of most of the states, and the distribution will begin in a few weeks. These standards will serve an important use in educating students to ideas of accuracy in this most important matter. The general government has already supplied to each of the states, for use as state standards, full sets of English weights and measures, and also balances. Upon the passage in July, 1866, of the act legalizing the metric system in the United States, the general government also furnished to each state complete sets of metric weights and measures. These sets are kept at the respective seats of government, and are available for the verification of the standards used by the county or town sealers of weights and measures. Being all carefully adjusted to a common standard, their use will procure practical uniformity in weights and measures throughout the country.

Geological survey.

Topographical work. — Congress having authorized the extension of the work of the geological survey into the older states, topographical work, preparatory to geological study, was commenced in the southern Appalachian region shortly after the adjournment of congress last August. A division, consisting of one party for carrying on triangulation, and three for topography, was organized at Bristol, Tenn. Triangulation was extended north-west-ward from the Coast Survey belt along the Blue Ridge, the line 'Benn Knob to Poore's Knob,' as determined by the Coast and geodetic survey, serving as a base. About 5,000 □ miles only were surveyed, as the season for field-work was short, and the weather very unpropitious. The area surveyed includes portions of the high mountain region of east Tennessee, western North Carolina, south-western Virginia, and eastern Kentucky.

For the purpose of testing thoroughly the practical value of Mr. G. K. Gilbert's method of reducing barometric observations, four barometric stations were established about and on the summit of Roan Mt., N.C., at elevations ranging from 2,000 to 6,300 feet, and connected with one another by level lines.

Besides the work of this division, geographic work was carried on in northern California, looking towards mapping the Cascade range, with a view of studying its volcanic phenomena.

Another geographic division continued the work in western New Mexico, commenced the previous year; while a fourth division commenced work in southern Montana, near Bozeman.

Besides these four divisions engaged upon general geographic work, a number of parties were engaged upon special and more detailed surveys. Among these surveys may be mentioned that of the quicksilver mining-districts of California, of the Silver cliff and other mining-districts of Colorado, and the surveys for tracing out the shore-lines of the fossil lakes of western Nevada and Oregon.

National museum.

Telegraphic announcement of the stranding of large marine animals. — A short time ago the men at the different life-saving stations along the entire coast were instructed by Supt. Kimball to telegraph to Washington the stranding of any large marine ani-

mal, immediately upon its occurrence. The first fruit of this excellent system, in the form of a highly interesting shark, arrived at the Smithsonian Institution on the 14th inst., from Amagansett, Long Island. To indicate the importance which this new departure seems likely at once to assume, it may be stated that this first specimen, having been examined by Dr. T. H. Bean, curator of the department of fishes, proves to be a species of Pseudotriacis, a genus of which no representative has been hitherto recorded as occurring in the western Atlantic. The species, P. microdon, to which the Amagansett shark belongs, was made known in 1867, by Capello, from the coast of Portugal.

Bureau of Ethnology.

Cliff dwellings in the Cañon de Chilly. — The ethnologic and archeologic researches that were begun a few years ago in the north-west were continued during the present season in that region known as the San Juan, principally in the cañons formed by the drainage of that river and its tributaries. The examinations of ruins were conducted in Cañon de Chilly and some of its principal side cañons, by Col. James Stevenson; and some important and interesting discoveries and collections were made. About forty-five ruined villages and dwellings were visited, many of which were carefully explored. Several of the more important villages were surveyed, and careful measurements taken, from which to construct models. About one-fourth of the number of ruins observed in these cañons were situated so high up in the sides of the cliff walls as to be inaccessible. Those, however, from which the finest specimens were obtained, and which presented the most novel features of architecture, were reached. One village, in this connection, is worthy of special mention. It is located in a side cañon of the de Chilly, about twelve miles from its junction with the main valley. The ruins occupy a space of about 900 feet in length by an average width of 125 feet. It is located in a large cave-like opening, whose arch circles over the village to a height of about 200 feet. Some of the houses have tumbled completely down; others are in a partial state of preservation; and a few are so well preserved as to present the whole plan of architectural design, as well as all the details of the masonry. This dwelling showed, that, wherever implements were used in its construction, they were made of stone; and no evidence appeared that the inhabitants had any knowledge of metal. The implements were all either of bone, stone, or wood.

At intervals among the ruins stood the walls of four estufas, in a sufficient state of preservation to enable one to define very closely the character of the original structure. These were circular, but varied quite essentially from estufas of the present day. The interior of one of these has a wide band, laid on in bright, durable colors, running entirely around the structure, resembling a Greek fret, with narrow bands above and below, and with the interior spaces filled with curious artistic designs. The walls in the rear of the ruins are literally covered with picture-writing, and in every convenient spot may be seen small cup-like cavities produced by sharpening stone implements.

In front of the village was found a burial cist, or artificially constructed oven-shaped pen, in which were found the remains of four human skeletons. The manner and care manifested in the burial of these dead may be taken as a type of the burial-customs of the cliff-dwellers. This cist, or oven, was composed of small logs, stones, and plaster. The diameter of the urn at the bottom is about four feet, closing toward the top in the shape of a dome. The logs were laid one on the top of the other, earth thrown up around the outside, and the interior heavily coated with plaster. The skeletons were doubled up like mummies, though buried without being wrapped in cloth or clothing of any kind. These skeletons were secured, and brought to the National museum. Among the *débris* of these same ruins were found many objects of dress and clothing, several kinds of moccasons or sandals, showing fine workmanship and skill in weaving, and many other objects illustrative of the art, manners, and customs of the cliff-dwellers; a full account of which will appear in Major Powell's official report from the bureau.

PUBLIC AND PRIVATE INSTITUTIONS.

Harvard college observatory.

Transmission of astronomical intelligence. — An association of about fifty European observatories has recently been formed for this purpose, with its headquarters at the Royal observatory, Kiel, Germany, directed by Prof. Krueger, who has taken charge of the business of the association. Connections by cable have been established with South America, South Africa, and Australia; and the observatory has been requested to co-operate with it, in the United States, by receiving and distributing in this country the telegraphic information sent from Kiel, and by forwarding to Kiel by telegraph any similiar information of importance collected from American astronomers. By the courtesy of Prof. Baird, secretary of the Smithsonian institution, the function hitherto performed by the institution, of collecting and transmitting announcements of discovery, has been transferred to the Harvard college observatory.

The importance of the work thus begun requires that a special officer of the observatory should be intrusted with it. Mr. John Ritchie, jun., has accordingly been appointed assistant in charge of this service, and the details of the proposed system are explained by him in a circular, which may be had on application.

American astronomers are requested to send to the "Harvard college observatory, Cambridge, Massachusetts," telegraphic information of discoveries of comets, asteroids, or phenomena of any kind requiring immediate attention. Arrangements will be made to refund the cost of such telegrams to the senders when their contents are of importance. It is very desirable that the messages should conform to the principles stated in Mr. Ritchie's circular.

It is intended that the distribution of information in this country shall be of such nature as to be productive of the greatest possible benefit, and will be of the broadest possible character. Discoveries, whether by American astronomers or by foreigners, will be circulated through the associated news companies, by special circulars of the Science observer, and by special telegrams.

NOTES AND NEWS.

— The National academy of sciences at its last meeting appointed a committee, of which Prof. C. A. Young is chairman, and Prof. J. H. C. Coffin secretary, to arrange plans for observing the total eclipse of the sun of May 6 next. This eclipse is of unusual importance, as the duration of totality at its maximum value is 5 m. 55 sec. Unfortunately, the path of the shadow lies wholly in the Pacific Ocean, and

there are only a few small islands from which observations are possible. Mr. C. H. Rockwell, at the recent meeting of the American association, suggested the feasibility of sending an expedition to Caroline Island, which is situated in latitude 10° south, and longitude 150° west; and his plan has been adopted by the committee. A small appropriation of $5,000 was asked from Congress to defray the necessary expenses, and forms one of the items in the sundry civil bill now under consideration, with little doubt of its being granted.

The expedition leaves New York to-day by steamer for Callao, *via* Panama. At this point, through the courtesy of the secretary of the navy, a man-of-war receives the party, and conveys them to Caroline Island. This is a small coral island, and said to be inhabited by a few persons. It is near the central line, and will give the observers a period of about five minutes, or a few seconds more, of the total phase.

The members of the party are as follows: Prof. E. S. Holden of Madison, Wis.; Mr. C. H. Rockwell of Tarrytown, N.Y.; Prof. C. S. Hastings of Baltimore; Mr. E. D. Preston, U. S. coast-survey; Mr. W. Upton, U. S. signal-office; and Ensign Brown, U. S. navy. The party will be further increased by two English astronomers sent by the Royal society, who will join the expedition at Panama.

The most important observations planned are a search for intra-mercurial planets, spectroscopic observations, and photographic work. The last named is wholly in the hands of the English guests of the party. Professor Hastings has planned the spectroscopic work, and will use a $6\frac{1}{4}$-inch, a $4\frac{1}{10}$-inch, and a $2\frac{1}{4}$-inch telescope. The first named is fitted with a grating for examination of the chromosphere before and after totality, and with a large prism for special study during the total phase of the outer corona. The second is provided with a grating, and also a single prism, and is designed for use in studying the relative lengths of lines reversed just before totality, and the limits to which the line 1474 K can be traced. The smallest instrument has a 30° prism of flint-glass placed before its objective, and is designed for observing the relative heights and brightness of the rings H_α, H_β, H_γ, H_δ, D_3, and 1474 K.

The instrumental outfit includes, in addition, a 6-inch telescope, a 4-inch and a $2\frac{1}{4}$-inch polariscopic apparatus, and meteorological instruments for studying radiation and other phenomena.

It is probable that the expedition will arrive at Caroline Island the latter part of April. After the eclipse the naval vessel will sail for Honolulu, from which the party will return *via* San Francisco. The Coast-survey observer carries a pendulum, which will be swung at various points as occasion offers. The chances of fair weather are very good, and the outlook for the success of the expedition seems in every way to be favorable. It is not known that any other expedition will be sent to observe the eclipse; though a French expedition to observe at Flint Island, which is near Caroline Island, has been planned.

— The American members of the International congress of electricians, which assembled in Paris in 1881, were: Hon. Levi P. Morton (American minister), Prof. G. F. Barker of Philadelphia, Major D. P. Heap, U.S.A., Dr. Cornelius Herz, Lieut. T. C. Maclean, U.S.N., and Prof. Henry A. Rowland of Baltimore.

The members chosen by the U. S. government to represent them at the Electrical conference, held in October, 1882, — of which an account is given in our leading article, — were Prof. Henry A. Rowland of Baltimore, and Prof. John Trowbridge of Cambridge.

— Not a few of our younger scientific men will feel a personal loss in the recent death of Hon. Paul A. Chadbourne, president of the Massachusetts agricultural college. Previously president of the University of Wisconsin and of Williams college, earlier professor at the latter institution and at Bowdoin college, an instructor in chemistry, materia medica, geology, botany, zoölogy, and natural theology, he has been brought all his life into contact with young men, and has impressed them with his earnestness. Occupied in too many and too varied pursuits to give his strength to research, but possessed of native powers and intuitive perceptions which would have enabled him to accomplish much in such a field, he has yet encouraged so many young men in the beginning of their career, — men who to-day hold their own in American science, — that his name deserves honorable mention here. He was a man of intense activity and diversified talents; being perhaps equally known as preacher, legislator, lecturer, and manufacturer, but best of all as an instructor. He died in his sixtieth year.

— A course of seven free Saturday-night lectures at the Cooper Union, New York, commencing Feb. 17, is announced as follows: Miss L. Von Finkelstein, on Domestic and city life in Jerusalem; Rev. J. C. Eccleston, D.D., on Columbus and his companions; Dr. Samuel Kneeland, on the Sandwich Islands, the land of fire; the same lecturer, on Iceland, the land of desolation; Prof. H. L. Fairchild, on Animal self-defence; the same lecturer, on Prehistoric man; the last of the course by J. H. Wilson, Esq., on Spain. All the lectures will be illustrated.

— At a meeting of the American philosophical society held at Philadelphia on Feb. 21, the subject of glacial motion was treated by Professors Lewis, Frazer, and Lesley; Prof. Lewis discussing the various causes assigned for the extension and southward flow of the great glacier, Prof. Frazer recounting the observations of Messrs. Peach and Horne on the glaciation of Scotland, and Prof. Lesley giving an amusing description of the rival theories of British glaciation urged by different geologists.

—Prof. C. S. Sargent of Harvard university has in preparation a new North-American Sylva. The drawings will be made by Mr. Charles E. Faxon, and the work will be published by the U. S. government.

—The latest numbers of the zeitschrift of the Berlin Gesellschaft für erdkunde (h. 4 and 5, xvii. 1882) contain papers on Russian surveys in 1881, by Lademann; Haussknecht's travels in Asia Minor and Persia, by H. Kiepert; on some Branches of the Amazon, translated from the Portuguese by W. Reiss, with a map showing the great irregularity of the channel between long. 55° and 60° W. Gr., and its frequent expansion into lakes.

—One of the tables at the zoölogical station at Naples is occupied the present season, by appointment of the University of Cambridge, Engl., by an American, Miss Emily A. Nunn, formerly professor of biology at Wellesley college, Wellesley, Mass.

—The Boletim da sociedade de geographia de Lisboa, 1882, No. 5, contains continued articles on the Portuguese possessions in eastern Africa, translated from O'Neill's observations, on Portuguese colonies (No. xx., in Belgium), and on the island of St. Nicholas (Cape Verde); and the results of meteorological observations in Loanda, 1879–81, by Coelho, from which we note the following factors. The barometric pressure (at an altitude of 59 met.) has its maximum of 759 mm. in July or August, and minimum 755 in January or February; the daily variation is 2.7 mm. The temperature averages 23° C., varying from 19° in July or August to 25° or 26° in February, with an average daily range of from four to eight degrees; the absolute maximum is 31°.7, and absolute minimum, 13°.5. The relative humidity averages 82, and rarely falls below 70. The west wind is much more frequent than any other, and seems to bring two seasons of rain, one about December, and a greater one about April; but in the three years of observation the results are very variable, 1879 giving a total rain of 571 mm., and 1881 having only 134. From May to October inclusive, very little rain falls; and June, July, and August are practically rainless. Evaporation carries off about 1.9 met. of water a year, and cloudiness averages five in a maximum of ten.

—During the last tourist-season in the Alps, fourteen persons were injured in mountain-climbing, three of them fatally. Bohren of Grindelwald was struck by lightning on the Wetterhorn, and instantly killed. Notary v. Hütte of Bern, in attempting an ascent of the Wilde Frau, had lowered a companion by a rope over a steep wall some fifteen feet high; but was severely hurt in jumping after him, and died from his injuries. A son of Surgeon Wahli of Bern fell on the Niesen, while picking *alpenrosen*, and was dead when found.

—In October of last year, a society was organized in Ottawa, Canada, called the 'Ottawa microscopical society,' with J. F. Whiteaves, Esq., F. G. S., as president, and J. B. Tyrrell, B.A., as secretary and treasurer. During the winter papers have been read and illustrated on the following subjects: Deep-sea soundings; Microscopic structure of rocks; Some insect parasites; Diatoms; and Human cellular tissue. The summer will be given to collecting, and next winter the society hopes to have a large amount of material for study.

—An ingenious device for stirring up sluggish fish, as a preliminary to catching them through the ice, is mentioned by Lansdell in his recent book of travels, *Through Siberia*, as being employed by the natives on the river Irtish. The process is there specially applied to the capture of sturgeon, which in winter congregate in muddy hollows in the bed of the river, where they lie motionless for the sake of the warmth. The fishermen cut holes in the ice, and set spring-lines at them, and then proceed to heat a number of balls of clay red hot, and to throw them into the river below the bait. The heat rouses the fish, which rise, swim up the stream, and are caught. It would be of interest to determine by experiment whether any of our own food-fishes could be induced to take bait by inciting them to activity by means of heated bricks.

—The Acadian science club has been formed in Nova Scotia for the encouragement of home study. The 'Acadian scientist,' published at Wolfville, N.S., is its official organ.

—There seems to be a common impression that the nickel five-cent piece was intended to weigh five grammes and to measure two centimetres. The coinage of 5-cent nickel coins (nickel and copper alloy) was authorized by an act of Congress May 16, 1866, and was begun during that fiscal year. The act left the shape and devices upon the coin to the discretion of the director of the mint, subject to the approval of the secretary of the treasury. The weight of the coin was fixed at 67.16 grains, or 4,352 milligrammes, with a margin of 2 grains or 125 milligrammes each way to allow for accidents of coinage. Three five-cent nickels of the date 1866 were found to weigh 4.828, 4.869, and 4.920 grammes respectively. Two of the date 1872 weighed 4.906 and 4.982. Seven coins of different dates measured twenty *and one-half* millimetres within one-tenth of one millimetre.

Evidently there was no intention to make the coin two centimetres in diameter, nor to have it weigh either four grammes or five. It may be remarked that all the coins are above the legal limit of weight (4.48 grammes).

—The National convention of agriculturists held at the U. S. department of agriculture the last week of January called together delegates from nearly every state in the union. The first and second sessions (Jan. 23 and 24) were devoted to a discussion of

agricultural colleges and societies, and of the general subject of agricultural education. Papers were read by Dr. O. C. Abbott of Michigan, Mr. Augustine Smith, Hon. Jno. A. King, Prof. J. A. Holmes of North Carolina, and Hon. D. W. Aiken of South Carolina.

Animal industries were discussed on Jan. 25, 26, and 27; and papers were presented by Mr. R. Baker of Ohio, Dr. James Law of New York, Mr. R. V. Gaines of Virginia, Mr. T. D. Curtis of New York, Mr. H. B. Guiler of Illinois, Mr. Ezra Stetson of Illinois, Prof. Wesley Webb of Delaware, and Dr. M. G. Ellzey of Virginia. Much interest was manifested in both of these sessions, and the general discussions were animated and interesting. On the 29th, the last day, and the one set apart for the consideration of the cotton industries, there was a decided falling-off in attendance; many of the delegates having left for home Saturday night, the 27th.

These conventions which Dr. Loring has called together, and which he inaugurated a year ago, have been productive of much good in bringing representative agriculturists into closer relations with the department. They indicate the desire of the commissioner to study the wishes and opinions of the people in the management of the department, and thus to increase its usefulness.

— Advices received from the U. S. consul at Montevideo, through the Department of state, show an alarming condition of affairs in parts of Uruguay from the ravages of destructive locusts. Foreign countries frequently apply through the state department for copies of the two reports of the U. S. entomological commission on the Rocky-Mountain locust; and it may be well to announce that they were published under the interior department, and are both out of print. The agricultural report for 1877 contains a condensed account of the more practical chapters by Professor Riley, and this may yet be obtained of the commissioner.

— The agricultural committee of the house has agreed to report favorably a bill introduced by Mr. Anderson of Kansas, which empowers the President to appoint nine commissioners whose duty it shall be to investigate thoroughly the movements of agricultural products from points of production to their final markets, the actual cost to the common carrier and his profits, and all matters which practically affect the difference between the prices received by the producer and those paid by the consumer.

— In Salusbury's translation (p. 79) of Dialogue first of Galileo on 'His Systeme of the World,' 1661, Sagredus is made to say, "You put me in mind of a man, who would have sold me a secret how to correspond, by means of a certain sympathy of magnetick needles, with one that should be two or three thousand miles distant; and I telling him, that I would willingly buy the same, but that I desired first to see the experiment thereof, and that it did suffice me to make it, I being in one chamber, and he in the next, he answered me that in so small a distance one could not so well perceive the operation; whereupon I turned him going, telling him that I had no mind at that time to take a journey unto Grand Cairo, or to Muscovy, but that if he would go himself, I would perform the other part, staying in Venice."

RECENT BOOKS AND PAMPHLETS.

Amateur mechanics: an illustrated monthly magazine; conducted by Paul N. Hasluck. Part 1. London, *Trübner*, 1883. 32 pl. 8°.

Amos, S. The science of politics. London, *Paul*, 1883 (Intern. sc. series). 496 p. 8°.

Bell, Alexander Graham. Upon the electrical experiments to determine the location of the bullet in the body of the late President Garfield; and upon a successful form of induction balance for the painless detection of metallic masses in the human body. Wash., *Gibson pr.*, 1882. 58 p. 8°.

Boase, H. S. A few words on evolution and creation. London, *Leng*, 1883. 276 p. 8°.

Buffalo — Naturalist's field club. Bulletin. Vol. 1. nos. 1-2. Buffalo, *Hicks pr.*, 1883. 48 p. 8°.

Campbell. J. L. Geology and mineral resources of the James River valley, Va.; with map and geological sections. N.Y., *Putnam*, 1883. 119 p. 8°.

Charmes, Gabriel. Five months in Cairo and in Lower Egypt; transl. by W. Conn. London, *Bentley*, 1883. 356 p. 8°.

Crowe, A. H. Highways and byways in Japan: the experiences of two pedestrian tourists. London, *Low*, 1883. 318 p. 8°.

Duncan, J. Life of John Duncan, Scotch weaver and botanist; with sketches of his friends and notices of the times, by W. Jolly. London, *Paul*, 1883. 524 p., portr. 8°.

Grierson, J. B. Electric lighting by water-power. London, *Spons*, 1883. 8°.

Hinrichs, Gustavus. Notes on cloud forms and the climate of Iowa. Iowa City, 1883. (12) p. illustr., map. 8°.

Hoar, C. Mensuration made easy; or, the decimal system for the million. London, *Wilson*, 1883. 84 p. 8°.

Jackson, L. D'A. Hydraulic manual; consisting of working tables and explanatory text. Intended as a guide in hydraulic calculations and field operations. *4th ed.* London, *Lockwoods*, 1883. 496 p. 8°.

Lackowitz, W. Bilder aus dem vogelleben Norddeutschland und seiner nachbarländer, nach skizzen von Paul M. Röper bearb. 1. lief. Berlin, *Ebhardt*, 1883. 24 p. l. 8° (to be completed in 25 parts).

Meigen, W. Die deutschen pflanzennamen Wesel. *Kühler*, 1882. 27 p. 8°.

Nature studies. By Grant Allen, Andrew Wilson, Thomas Foster, Edward Clodd, and Richard A. Proctor. London, *Wyman*, 1883 (Knowl. libr.). 322 p. 8°.

Nemontis, W. S. Darwin's evolution theory not supported by evidence. London, *Sampson*, 1883. 23 p.

Ohio meteorological bureau. Report for October, November, December. 3 nos. n.p., 1882. 16, 24, 34 p. 8°. — Circular of information, 9 p.

Perry, J. Practical mechanics. London, *Cassell*, 1883. 270 p. illust. 12°.

Proctor, R. A. The stars in their seasons; an easy guide to a knowledge of the stars, exhibiting, in twelve large maps, the appearance of the heavens at any hour of the night, all the year round. London, *Wyman*, 1883. 8°.

Rawlinson, G. Antiquity of man, historically considered. London, *Rel. tract. soc.*, 1883. 44 p. 8°.

Smith, G. Assyrian discoveries; an account of explorations and discoveries on the site of Nineveh, during 1873 and 1874. *7th ed.* London, *Low*, 1883. 466 p. 8°.

Smith, G. The geography of British India, political and physical. London, *Murray*, 1883. 570 p., maps. 8°.

Wilkinson, H. Sunny lands and seas; a cruise around the world in the S. S. 'Ceylon.' London, *Murray*, 1883. 8°.

Williams, W. Matthieu. Science in short chapters. N.Y., *Funk & Wagnalls*, 1883. 308 p. 12°.

Year-book of pharmacy. 1882. London, *Churchill*, 1883. 607 p. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

THE CORRESPONDENCE OF THOMAS CARLYLE AND RALPH WALDO EMERSON: 1834 TO 1872.

With fine Portraits of Carlyle and Emerson etched for this work. Edited by CHARLES ELIOT NORTON. Two volumes. 12mo, gilt top, rough edges, $4; half calf, $8.

"Each of the delightful letters in these volumes is a chapter of wisdom."—*Philadelphia Bulletin.*

"It is almost a unique work in presenting the unreserved thoughts of perhaps the two most remarkable men of their age in either hemisphere."—*Hartford Courant.*

"It would be hard to find letters more graceful in style, more rich in ideas, and more fragrant in all that makes friendship sacred, than this correspondence. . . . They talked to each other with all the best faculties of mind and heart, alert and active."—*Christian at Work.*

"It was a most choice friendship of two highest, rarest souls: their letters show this as nothing else can show it."—*Philadelphia Times.*

"They will make themselves everywhere read, partly for their superior tone of thinking and feeling, and partly for the details, so dear to a gossiping world, of many a social, political, and literary circle of famous men and women, now departed or soon to vanish from the earth."—*Springfield Republican.*

"Fascinating as revelations of character."—*New-York Star.*

"It will be for long a source of enjoyment and discussion to students of character and literature."—*New-York Tribune.*

THIRD EDITION OF

SHORT SAYINGS OF GREAT MEN.

With Historical and Explanatory Notes. By SAMUEL ARTHUR BENT, A.M. $3.

"The work is one of astonishing research. It is a most fascinating contribution."—*Philadelphia Press.*

JAMES R. OSGOOD & CO., BOSTON.

THE

BRADSTREET COMPANY'S

Binding Department.

This department having been recently re-organized, we are now prepared to execute orders for every description of Binding in Leather, from the ordinary periodical to the finest work in vellum, levant, morocco, calf, and russia, with elaborate hand-tooling.

The attention of private illustrators is especially invited.

THE BRADSTREET COMPANY,

Charles F. Clark, President, Nos. 279 to 283 Broadway, New York.

JOHN WILEY & SONS,

ASTOR PLACE, NEW YORK,

PUBLISH

FIELD ENGINEERING.

A handbook of the theory and practice of railway-surveying, location and construction designed for classroom, field, and office use, and containing a large number of useful tables, original and selected. By WILLIAM H. SEARLES, C.E., late Professor of Geodesy at Ren's Polytechnic Institute, Troy. This volume contains many short and unique methods of laying out, locating, and constructing compound curves, side-tracks, and railroad lines generally. It is also intended as a text-book for scientific schools. Pocketbook form. Fourth edition. 1882. 12mo. Morocco. $3.

THE RAILROAD SPIRAL.

The theory of the compound transition curve reduced to practical formulæ and rules for application in field-work, with complete tables of deflections and ordinates for five hundred spirals. By WILLIAM H. SEARLES, C.E., author of "Field Engineering," member of American Society of Chief Engineers. Pocketbook form. $1.50.

MATERIALS OF ENGINEERING.

A work designed for engineers, students, and artisans in wood, metal, and stone; also as a Text-book in scientific schools, showing the properties of the subjects treated. By Professor ROBERT H. THURSTON. Well illustrated. In three parts. Part I. The Non-Metallic Materials of Engineering and Metallurgy, with measures in British and metric units, and metric and reduction tables. 8vo. $3.50. Part II. Iron and Steel. 8vo. $5. Part III. The Metallic Alloys (shortly). 8vo.

ORGANIC CHEMISTRY.

Introduction to organic chemistry. Translated from the German of A. PINNER, Professor of Chemistry at Berlin, with additions and revisions, by Professor P. T. AUSTEN of Rutgers College. A text-book for the use of colleges and high schools. 12mo. Cloth. $2.50.

"This is a model book, and one every teacher and student of organic chemistry will welcome, etc."—*Journal of Education.*

To buyers engaged in the all-important business of furnishing their houses we would be pleased to show our new productions, thus indicating the rapid advancement of art education in this branch of industry.

F. Geldowsky Furniture Co.

Second St., E. Cambridge, Mass.
Horse-Cars from Scollay Square, Boston, every five minutes.

☞ The issue of March 23, 1883 (No. 7), will contain a classified list of the subscribers to this new journal, giving their titles and addresses This list, numbering already about 1,500 names, includes many of the best-known people in America.

SCIENCE is a strictly independent journal, devoted to the advancement of knowledge and scientific research in America, and is technical only in so far as the subject-matter requires. It claims the support of scientific men as the most available channel for the early publication of condensed results of their researches, and appeals to the intelligence of the general public by its careful exposition of scientific discovery, while both will profit by its weekly reports of scientific progress, drawn from original sources of the latest date, and from all parts of the world.

SCIENCE offers a ready and rapid means of intercommunication between the scattered scientific men of America, which they have never yet enjoyed, and will endeavor to become, in a high sense, the exponent of the best scientific thought of the country; and its impartial reviews of native and foreign scientific literature ought to be welcomed by every person of ordinary culure. Particular attention will be paid to current periodical literature and the proceedings of learned bodies, which give the latest results of scientific study. Arrangements have been made for their early receipt, often in advance of ordinary publication; and the miscellaneous material so obtained is carefully digested, and presented under specific heads. This prominent feature, which has never before been introduced in a weekly journal, will be particularly attractive to the specialist, in whatever branch, as he will at once know where to look for the latest information about all the more important work in his own field of investigation.

SCIENCE purposes to furnish original articles by the most capable writers on the results of scientific research, to urge the importance of scientific education, and to illustrate the applications of scientific principles to all matters pertaining to national progress and practical affairs of every kind. The scope of SCIENCE will be as broad as its name: in every field of inquiry where the scientific method is adopted, it will hope to enter. Chronicler of the latest discoveries, but without affecting to hold a judicial position, it will indicate their relation to current thought and philosohpy, as well as to the

exigencies of daily life, in a fearless yet reverent spirit, — not too hasty in supporting plausible hypothesis, but ever open to the truth.

To promote one of its chief objects, and as a distinctive feature of the journal, SCIENCE will give its hearty support to those who are endeavoring to introduce the study of the natural and physical sciences into public and private schools, by drawing attention in every possible way to the high importance of this measure, as well as by giving illustrated articles, plainly worded, prepared by skilful hands, to guide the efforts of the teachers.

Practical men will find in SCIENCE carefully written papers on the applications of the principles of mechanics and other branches of physics to all departments of industry and technology. The unprecedented recent advances in the applications of electricity demand for them a prominent place; while optics, acoustics, thermodynamics, mining, metallurgy, engineering, mechanical processes, and all forms of motive power, will receive their fair share of attention.

SCIENCE has secured in advance the good-will and active support of a large body of the most competent scientific men of the country, as will sufficiently appear upon an inspection of any of its numbers.

Communications are welcomed from any quarter, and a fair price will be paid for such as are accepted.

Secretaries of scientific societies all over the world, and authors and publishers of works on scientific subjects, are invited to send their publications for notice to the editor as soon as possible after issue.

The first volume of SCIENCE began on Feb. 9, 1883, and will close June 29, 1883. Each issue will regularly contain twenty-six (26) pages of text wholly free from any kind of advertising; but often, during the year, an issue, like the present one, will contain more than twenty-six pages; so that the two volumes comprised in one year will make about 1,500 pages of text. At the close of each volume an appropriate titlepage and carefully prepared indexes will be furnished to subscribers. The subscription price for one year is $5.00 to any address in the United States and Canadas, and $6.00 to any address in the other countries of the International Postal Union. Single numbers are 15 cents a copy.

Advertisements inserted only when found unobjectionable to the Editor. Those containing information of value to scientific men preferred, and given the most desirable location.

THE SCIENCE COMPANY,

MOSES KING, *Publisher.*

THE SCIENCE COMPANY.

Organized, 1883, under the laws of the Commonwealth of Massachusetts.

PRESIDENT: DANIEL C. GILMAN, *Baltimore, Md.*

VICE-PRESIDENT: ALEXANDER GRAHAM BELL, *Washington, D.C.*

DIRECTORS: Daniel C. Gilman of Baltimore, Alexander Graham Bell of Washington, Gardiner G. Hubbard of Washington, Othniel C. Marsh of New Haven. TREASURER: Samuel H. Scudder of Cambridge.

Offices of the Company, the Publisher, and the Editor: CAMBRIDGE, MASS.

FRIDAY, MARCH 9, 1883.

SPENCER FULLERTON BAIRD.[1]

THE ancestors of the present secretary of the Smithsonian institution were of English, Scotch, and German origin. The grandparents were Samuel Baird of Pottstown, Penn., and Rebecca Potts. Their son Samuel was a lawyer established at Reading, Penn., where Spencer Fullerton Baird was born Feb. 3, 1823. His great-grandfather on his mother's side was the Rev. Elihu Spencer of Trenton, whose pulpit-eloquence during the war for independence brought him the honor of having a price set on his head by the British government.

Samuel Baird was a man of fine culture, a strong thinker, close observer, and lover of nature and out-of-door pursuits. He died in 1833; but his children, especially his sons William and Spencer, were largely influenced by their father's tastes, and early began the collection of specimens in natural history. They worked together; and there are still, in the museum at Washington, specimens of birds prepared by these boys forty-five years ago, by a simple process of evisceration, and then of stuffing the body-cavities with cotton and arsenical soap. The older brother entered the legal profession, and at the time of his death, in 1872, was U. S. collector of internal revenue at Reading.

The younger continued his studies and natural history pursuits without interruption. He entered Dickinson college in 1836, when only thirteen years old, and was graduated in 1840. He afterward carried on some studies in medicine, but never formally completed the course, and received his degree of M.D. *honoris causa*. His early interest in natural history was steadily encouraged and fostered. He was not compelled into a profession, but allowed to exercise the fullest freedom in researches and collections. A strong stimulus was in the friendship of Audubon, which he formed as early as 1838, while he was still a student in college. He was only prevented by ill health from accompanying Audubon as his secretary on his six-months' expedition to the Yellowstone in 1840. The older naturalist, in 1842, gave the younger the greater part of his collection of birds, including most of his types of new species. It was in these early years, also, that he formed

[1] For the portrait of Professor Baird, here given, SCIENCE is indebted to the liberality of the Photo-engraving company of New York.

lifelong friendships and associations with George N. Lawrence, John Cassin, John G. Morris, Thomas M. Brewer, and S. S. Haldeman.

In 1846 he was chosen professor of natural history in Dickinson college, and the next year accepted the additional work of chemistry. He remained in this position until 1850, declining a call, which he received in 1848, to a corresponding chair in the University of Vermont. His college-work included instruction of the seniors in physiology, of the sophomores in geometry, and of the freshmen in zoölogy; but the period was one, also, of great activity in collection and research, and in the beginning of his extensive publications. He found time to carry on the work begun in previous years, and to make, in summer, extended collecting expeditions to the Adirondacks in 1847; to Ohio in 1848, to collect, in company with Dr. Kirtland, from the original localities of the types of the fishes described by him in his work on the fishes of Ohio; to the mountains of Virginia in 1849; and to Lakes Champlain and Ontario in 1850. His fine physique and consequent capacity for work is doubtless due in part to his out-door life during these years. In 1843 he made pedestrian collecting-tours, the length of which was over 2,200 miles.

The first printed paper which bears his name is a description of two new species of fly-catchers, which was published in the Proceedings of the Philadelphia academy of natural sciences in 1843. As early as 1846 he was engaged in the preparation of a synonymy of North-American birds; and the next year he met Agassiz, just arrived from Switzerland with Desor and Girard. Then, or shortly after, was projected the work of Agassiz and Baird on The fresh-water fishes of the United States, which was, however, never published; although a number of illustrations, and some pages of text, were elaborated. Just before leaving Dickinson college, he undertook his first considerable literary work, — that of translating and editing the text for the Iconographic encyclopaedia, which was an English version of Heck's Bilder-atlas, published in connection with Brockhaus's Conversations-lexikon.

The work which he had already done had called attention to his scientific qualifications; and in 1850, upon the urgent recommendation of the late George P. Marsh, he was invited to Washington as assistant secretary of the Smithsonian institution, where he has ever since remained, succeeding to the secretaryship in May, 1878, upon the death of Professor Henry. The institution was then just issuing the first volume of its Contributions, and was in the first years of its organization. The main duty of the assistant secretary was the development of the natural-history collections. The only specimens in possession of the institution at the time of Professor Baird's arrival were a few boxes of minerals and plants. Professor Baird deposited his own already extensive collections, and these formed the nucleus of the Smithsonian museum. The collections of the Wilkes exploring expedition, which constitute the legal foundation of the United States national museum, were at that time under the charge of the National institute; and although, by the act of incorporation, the Smithsonian institution was the legal custodian of the 'National cabinet of curiosities,' it was not until 1857 that the regents finally accepted the trust, and the national museum was definitely placed under the control of the Smithsonian institution, and transferred to its building. Until this time, Congress had granted no funds for the support of the Smithsonian cabinets, and the collections had been acquired and cared for at the expense of the endowment fund. They had, however, become so large and important in 1857, that the so-called national collections at that time acquired were small in comparison.

The national museum, then, had a double origin. Its actual, though not its legal, nucleus was the collection gathered in the Smithsonian building prior to 1857. Its methods of administration, which were, in fact, the very same that had been developed by Professor Baird as early as 1845, when forming a cabinet in Carlisle, are those which are still in use, and

have stood the test of thirty years without any necessity for modification. In all this work Professor Baird and Professor Henry worked in harmony; and Professor Baird, since his succession to the secretaryship, has carried forward the same general system.

The growth of the museum has been very largely due to the scientific explorations which have been organized by the Smithsonian institution. The first grant ever made by the institution for scientific exploration and research was in 1848, to S. F. Baird, for the exploration of the bone-caves and the local natural history of south-eastern Pennsylvania. The direction of these explorations came at once under the duties of the assistant secretary, and remained throughout under his immediate care. In his reports to the secretary, published year by year in the annual reports of the institution, will be found the only systematic record of government explorations which has ever been prepared. The policy of the institution has, as is well known, always been to do such work as no other institution was able or willing to undertake. From 1850 to 1860 several extensive government expeditions were sent to the western territories; and it became the duty of Professor Baird to enlist the sympathies of the commanders of these expeditions in the objects of the institution, to supply them with all the appliances for collecting, as well as the instructions for their use. In most cases, also, he organized the natural-history parties, nominated the collectors, employed and supervised the artists in the preparation of plates, and in many instances edited the zoölogical portions of the reports. The fitting-out of such expeditions was only a small part of the work. From the beginning until now there have been thousands of private collectors who have derived their materials, their literature, and, to a considerable extent, their enthusiasm, from the Smithsonian institution. The Smithsonian 'instructions to collectors,' which has passed through several large editions, and many specific circulars of a similar character, were prepared by Professor Baird in connection with this department of his work.

In addition to this, the assistant secretary had from the outset the charge of certain departments of the routine work of the institution. The system of international exchanges, for instance, which had been one of the leading objects of the Smithsonian institution, was organized by him in its main details. Already, in connection with his private enterprises, he had developed a somewhat extensive system of exchanges with European and American correspondents; and the methods thus developed were expanded for the wider needs of the institution. His first task, after entering upon his duties, was to distribute the second volume of the 'Smithsonian contributions to knowledge;' and his hand may be seen in all the subsequent operations of this department; for the active oversight which he gave to the collecting and distributing work of the institution has not prevented him from continuous literary work. The extent of his contributions to science and scientific literature will be more readily seen after the publication of a bibliography of his writings, which is now in press, and will soon be issued as one of the bulletins of the national museum. The list of his works is complete up to the end of the year 1882, and contains 1,063 titles. Of this number, 775 are brief notices and critical reviews contributed to the Annual record of science and industry while it was under his editorial charge, 31 are reports relating to the work of the Smithsonian institution, 7 are reports as commissioner of fisheries, 25 are schedules and circulars officially issued, and 25 are volumes or papers edited. Out of the remaining 200, the majority are original contributions to scientific literature. Among the most elaborate of his original memoirs are the Catalogue of North-American serpents (1853), the Mammals of North America (1854), the Birds of North America (1858), the Review of North-American birds (1864–66), the Distribution and migrations of North-American birds (1865), and a History of North-American birds, in connection with Thomas M. Brewer and Robert Ridgway (1874). From 1870 to 1878 he was scientific editor of the periodicals

published by Harper & Brothers, and also edited their yearly cyclopaedia of science entitled the Annual record of science and industry.

Some idea of the scope of Professor Baird's work appears from the fact, that, of the total number of papers enumerated in the forthcoming bibliographical list, 73 relate to mammals, 80 to birds, 43 to reptiles, 431 to fishes, 61 to invertebrates (chiefly in the form of reviews), 16 to plants, 88 to geographical distribution, 46 to geology, mineralogy, and paleontology, 45 to anthropology, 31 to industry and art, 109 to exploration and travel. While the number of new species described does not necessarily afford any clew to the value of the work accomplished, it may be referred to as an indication of the pioneer work it was necessary to do, even in so prominent a group as that of the vertebrates. Among mammals there may be noted 49; birds, 70; reptiles, 186; fishes, 56. Forty-nine of two hundred and twenty, or nearly one-fourth of the mammals discussed in the Mammals of North America, were then described for the first time.

In 1871 Professor Baird was appointed by President Grant to the position of U. S. commissioner of fish and fisheries, — an unsalaried office, to the duties of which, for eleven years, he has devoted a large portion of his time. The literary product may be seen in the seven volumes of reports, and two of bulletins, issued by the commission; but the scientific results in research, and the economic results in stimulating a great industry, are difficult to measure. There has been a systematic investigation of the waters of the United States, and the biological and physical problems which they present; an examination of the methods of fisheries, past and present, and the statistics of production and commerce of fishery products; and an introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general government, or those common to several states. The commission is an admirable illustration of the application to practical purposes of sound science.

The value set upon Professor Baird's scientific attainments is indicated by the various positions of trust to which he has been called, and the recognition which he has received from learned bodies. In 1850 and 1851 he served as permanent secretary of the American association for the advancement of science. In 1876 he served as one of the Government board of commissioners to the international exhibition at Philadelphia, and was also a member of the international jury. In 1877 he was present as advisory counsel at the sessions of the Halifax fishery commission, and, since 1878, has been one of the trustees of the Corcoran gallery of art in Washington; he has been president of the Cosmos club, and for many years a trustee of Columbian university. In 1856 he received the degree of doctor of physical science from Dickinson college, and in 1875 that of doctor of laws from Columbian university. He was, in 1878, awarded the silver medal of the Acclimatization society of Melbourne; in 1879, the gold medal of the Société d'acclimatation of France; and, in 1880, the 'erster ehrenpreis' of the Internationale fischerei ausstellung at Berlin, the gift of the emperor of Germany. In 1875 he received from the king of Norway and Sweden the decoration of 'knight of the royal Norwegian order of St. Olaf.'

He was one of the earliest members of the National academy of sciences, and has for many years been a member of its council. Besides honorary relationship to many scientific societies in the United States, he holds a foreign membership in the Linnaean society and the Zoölogical society of London, and a corresponding membership in the K.-k. zoologisch-botanische gesellschaft (Vienna), the Sociedad de geographia (Lisbon), the New-Zealand institute, the Koninklijke natuurkundige vereeniging in Nederlandsch-Indië (Batavia), the Magyar tudomanyos akademia (Budapest), the Société nationale des sciences naturelles (Cherbourg), the Academia Leopoldino-Carolina naturae curiosorum (Jena), the Naturforschende gesellschaft (Halle), the Naturhistorische gesellschaft (Nuremberg), the Geographical society of Quebec, the Deutsche fischerei verein (Berlin).

METEORIC AND TERRESTRIAL ROCKS.

AN unavoidable delay in the completion of the plates of a work to be published in the memoirs of the Museum of comparative zoölogy has rendered it advisable to publish in advance a brief abstract of some of the results thus far obtained. The work will contain descriptions of the microscopic characters of meteorites and the allied rocks; their classification; collected and arranged chemical analyses; a discussion of the principles of classification; the origin of rocks; the present and past state of the earth in its bearings upon petrography, etc.

The previous delays in the publication of this work have been owing to other labors, a change of plan greatly extending its scope, and the fact that work of the proposed character is vastly more difficult than simply 'pigeon-holing' rocks in different species, according to the minerals they happen to contain.

The results which it is desired to present here are as follows: —

1. Petrographical research demands a former liquid globe, and one whose interior portions are either now liquid, or in such a condition that they can readily become so.

2. That the interior of the earth is now probably liquid, is shown not only from petrographical and geological research, but also by the fact that the best and more recent observations either prove or render it probable that iron and such rock materials as are believed to compose the *infra*-sedimentary portion of the earth are lighter when hot-solid, at or near the melting point, than they are at about the same temperature when liquefied. Hence, according to Thomson's law, pressure lowers their fusing point, instead of raising it.

3. No sinking of the earth's crust to the centre could take place; for, since the interior is heterogeneous, the crust on sinking would meet with material of higher specific gravity, the heat imparted to the sinking matter would cause it to grow lighter, and the viscosity of the material still liquid would retard its descent.

4. All so-called physical and mathematical demonstrations of the earth's solidity have been based on certain hypothetical globes of unlike constitution with the earth; and hence have not the slightest application to it, but to the hypothetical globes only.

5. All rocks originally came from the cooling molten material of the globe, and the chemical and sedimentary rocks have resulted from the disintegration of that material.

6. All eruptive or volcanic (including plutonic) rocks were derived from material which either had never solidified, or had been reliquefied; but they were not derived from sedimentary or chemical deposits.

7. In the shrinkage and fracturing of the earth's crust, the depression of any portion into the still molten interior would naturally displace and cause the heavier liquid to overflow, just as the fracturing and depression of ice causes the heavier water to overflow it.

8. Water is the accident of an eruption, and is not the cause. It is met by the lava on its way to the surface, but is not the cause of the advance towards that surface. Hence it is probable that explosive volcanic action has become more common in recent times, while quiet outflows were more abundant in past ages.

9. Regions of crystalline rocks are, as a rule, regions in which eruptive, or mixed eruptive and sedimentary, agencies have prevailed, and are of every geological age, — meaning, by eruptive agencies, the original and secondary results of a cooling globe, including thermal waters. Metamorphism is even more common in eruptive than in sedimentary rocks.

10. The original rock-materials of the universe are the same, from whatsoever region they come, and the same principles should be employed in classifying them; while the classification, to be natural, ought to express their relationships.

11. A natural classification of rocks should be based on all their characters taken as a whole. It must be an empirical one, as in zoölogy and botany; and ascertained by studying all known forms, and arranging them according to their petrological, lithological, and chemical characters, — taking the rocks as a whole, and considering all their relations.

12. The present received classifications of rocks are artificial, based on part of the characters to the exclusion of others; they correspond to the Linnean artificial botanical classification, and hold about the same relations to a natural classification of rocks as that does to the natural classification of plants.

13. The great mass of rocks separated from one another as distinct species in these classifications are mere varietal forms of certain definite natural species, — the variation owing to alteration, or to some little change in conditions.

Distinction should be made between superficial weathering and the chemical and molecular changes that go on in all eruptive rocks after

consolidation and exposure to the action of infiltrating waters: that is, changes in the rock-mass as a whole; a change from an unstable to a more stable condition, — a loss of energy.

14. The original or eruptive rocks of the universe form a continuous series from the most basic to the most acidic; but for convenience they are to be divided into definite species or groups.

15. The preponderance of characters, and not the presence or absence of any one mineral, ought to decide the place of any rock in the system, yet the latter is the fundamental basis of the received lithological classifications. The original characters of the rock ought to hold priority in classification over any secondary characters.

16. Geological age has no bearing on classification, beyond this: that the older the same rock is, under like conditions, the greater is its alteration. The greater number of the so-called rock-species of pre-tertiary age are the altered forms of rocks which were once identical with tertiary and modern rocks.

17. A natural classification, in its broader applications, can be employed in the field as well as in the laboratory; for, as a rule, all the characters of rocks are so related to one another, that from one set the others can be inferred with a fair degree of accuracy.

18. When complete (*bausch*) analyses are made of typical rocks, rock-species are believed to have in their broader features certain limits of chemical composition outside of which the normal forms rarely go, and inside of which the normal forms of other species rarely come; but the mineralogical composition is more or less unstable and variable, depending upon alteration and other conditions to which the rock has been subjected. The chemical relations of rocks would be much better shown if the percentages were expressed in terms of the elements, instead of their compounds.

19. All rocks, except meteoritic and recent volcanic ones, are more or less altered; and it is from these altered rocks that the received classifications and the principles of classification have been chiefly based in Europe, — unaltered rocks being apparently limited there to the few active volcanoes.

20. Fragmental or derived rocks should be classed, as far as possible, under the rocks from which they were derived.

21. The relation of a rock to its associated rocks in the field is the principal criterion for determining its origin. This is especially the case in the altered rocks.

As examples of my meaning, it may be pointed out that the gabbros are here regarded as basaltic rocks lying near the peridotites; melaphyrs and diabases are principally altered basalts, but some rocks so classed are altered andesites; the porphyrites, principally altered and older andesites, but part are more acidic rocks; the propylites, with few exceptions, are andesites which are less altered and younger than the porphyrites; diorites, more or less altered forms of basalts, andesites, etc.; the quartz porphyries and felsites, principally old rhyolites; the nevadite is largely a vitreous rock, and belongs rather with the trachytes than with the rhyolites; kersanton, to the gabbros; minette, partly to the basalts and partly to more acidic rocks; the augite porphyries, partly to the basalts and partly to the andesites; the phonolites, partly to the trachytes, and partly to the andesites; and so on. Many schistose rocks are also formed by the alteration of eruptive rocks.

The position to which any rock should be assigned depends upon its affinities; and, in the above, the determination is based on such specimens as have been seen, which had been named by other lithologists. It is not intended to claim that every rock called by a particular name belongs in the position here assigned that name.

In applying the principles and methods given here, in the bulletin of the Museum of comparative zoölogy, and in the proceedings of the Boston society of natural history, the writer has been led to classify the meteorites and the large but comparatively unknown series of terrestrial rocks that are more basic than the basalts, as follows: —

1. *Siderolite.* — In this species or group are included a series of rocks composed chiefly of iron, either native or in its secondary states, with or without nickel, schreibersite, pyrrhotite, graphite, etc. It includes all masses of iron or iron-ore that have fallen as meteorites, those that can be shown to be original or eruptive portions of the earth, or directly derived from them; i.e., fragmental deposits. No veins or chemical deposits of iron-ore are included. The analyses of this species are imperfect; for they do not, as a rule, convey an idea of the composition of the rock-mass, but rather of the component minerals, especially of the iron. It is much as if a chemist should analyze magnetite from basalt, granite, and rhyolite, and then consider his analyses as typical of the rocks from which they were taken. When a larger number of analyses have been made, showing the composition of

these rocks as a whole, it is possible that they can be divided into more than one species. As the analyses stand, the rock is composed of iron, either native or combined, with or without varying amounts of nickel, cobalt, tin, copper, sulphur, titanum, phosphorus, silica, graphite, etc. The specific gravity is high. The presence of graphite shows that it is not of organic origin in this case.

Many of the so-called meteoric irons are probably of terrestrial origin, and their environment ought to be carefully studied. The Wiedmanstattien figures are in some measure paralleled by the leucoxene and cleavage structure of titaniferous and magnetic iron in diabases, etc.

The name 'siderolite' was formerly given by Maskelyne to the species to which G. Rose had previously given the name 'pallasite'; hence, since the latter has the prior right, it is hoped that Maskelyne will allow the transference of the term 'siderolite' as his own, to this species, to which it most properly belongs, since its individuals are emphatically rocks of iron.

2. *Pallasite.* — This species is formed from a series of rocks of like origin to the preceding; and the structure is that of a sponge- or semi-sponge-like mass of iron, either native or secondary, holding silicates. The iron has the associations usual in siderolite; and this association holds good wherever the iron occurs in meteorites, and probably on more careful study will be found to hold good, to a great extent, in terrestrial rocks. The silicates are principally olivine alone, or in association with enstatite and diallage. More rarely feldspar and other silicates occur. There are but two or three complete analyses of the pallasites that can be regarded of value; Joy's [*Amer. journ. sc.*, 1864 (2) xxxvii. 243–248] being the best yet made. The silica increases in amount, up to some 30%, averaging about 20%, with variable quantities of magnesia, rarely exceeding 24%; while the remaining constituents are chiefly iron and its associates. Specific gravity less than in the siderolites.

Under pallasite are classed the supposed meteorites of Atacama, Bitburg, Brahin, Breitenbach, Krasnojarsk, Potosi, Rittersgrün, Rogue River, Sierra de Chaco, Singhur, and more doubtfully those of Hainholz, Mejillones, and Lodran. Of terrestrial rocks under the pallasites belong the olivine-magnetite rocks of Cumberland, R.I., and Taberg, Sweden; for which, as a varietal form, I would propose the name 'cumberlandite'. It is probable that many other pallasites will be found on careful investigation of the iron-bearing rocks. Some schistose rocks (actinolitic) are probably the result of the extreme alteration of the cumberlandite.

The Ainsa and Carlton meteorites from Tucson have a fine sponge structure, and contain numerous olivine (?) grains; but, although they approach the pallasites, they have been classed with the siderolites.

3. *Peridotite.* — This term, applied by Rosenbusch to the pre-tertiary terrestrial olivine rocks, I would extend to all terrestrial rocks and meteorites of a similar composition, — including every thing from the pallasites to the basalts. These rocks are composed principally of silicates and iron; the former preponderating, and the latter sometimes wanting. The silicates are principally olivine, enstatite, and diallage or augite, and sometimes feldspar. The iron is either native, or in the form of pyrrhotite, magnetite, chromite, etc. Silica and magnesia are more abundant, as a rule, than in the pallasites, and less so than in the basalts, while the iron is less than in the former. The specific gravity is also intermediate between the two above-mentioned species.

If it is desired, similar varieties can be pointed out in the meteoric peridotites as in the terrestrial forms; as, for instance, dunite (Chassigny), olivine-enstatite rock (Iowa Co., Knyahinya, Gopalpur, Lancé, Tourinnes, Waconda, Goalpara), lherzolite (Pultusk, Estherville, New Concord, etc.). Also, if desired, an olivine-enstatite-augite division can be made (Tieschitz, Hungen, Grosnaja, etc.).

While part of the meteoric peridotites are entirely crystalline, e.g., Estherville, the great majority are not so, but chondritic in structure. The chondritic structure I believe to be caused by the rapid solidification and arrested crystallization of the masses composed of minerals naturally taking a more or less rounded form; and not from mechanical action, as has generally been claimed. These chondrae show, as a rule, a light or dark gray finely fibrous or fibrous-granular base and semi-base, answering to the globulitic base of the basalts or the felty base of the andesites. This base has heretofore been described as a flocculent opaque-white material, a cloudy substance, the comminuted material, the feldspathic material, etc. Sometimes it is isotropic; but more commonly it affects polarized light according to the amount of olivine or enstatite granules formed in it. When crystallization goes far enough, these granules form by their union the enstatite and olivine grains and crystals.

The base united with the olivine or enstatite gives the structures which have been taken by Drs. Hahn and Weinland as of organic origin. I should expect to find the chondritic structure in terrestrial peridotites, if any can be found in which the crystallization had been arrested and subsequent alteration has not taken place.

The difference in structure between the rapidly solidified, or chondritic, and the crystalline peridotites is not any greater than that between the tachylitic, basaltic, doleritic, or diabasic state of the basalts.

All serpentines not veinstones, which have been carefully studied, appear to belong to peridotite, as a variety produced by alteration.

4. *Basalt.* — To the basalts I should assign such meteorites as those of Jonzac, Stannern, Constantinople, Petersburg, Juvenas, Shergotty, Charkow, Frankfort, Shalka, Massing, Busti, Manegaum, Ibbenbüren, etc., so far as their characters are at present known. These have a lower specific gravity than the preceding, a higher percentage of silica, less iron and magnesia, but more lime, and usually more aluminia.

Some of these meteorites, like the Shergotty and Manegaum ones, are apparently allied to the gabbro variety of basalt.

Beyond the basalts are a few imperfectly investigated forms, which, in the majority of cases, are regarded as doubtful meteorites, which appear to belong to the trachytes and rhyolites, but which require to be studied microscopically before definite statements can be made. Of these forms are some described by Shepard, Silliman, and Grewingk. The carbonaceous meteorites have been too little studied to be given a definite position yet; but, excepting the carbonaceous matter, they chemically appear to belong to the peridotites, although it is not improbable that they belong to a distinct species.

So far as studied, I would class the meteorites, the original and eruptive rocks, under the following species: 1°, siderolite; 2°, pallasite; 3°, peridotite; 4°, basalt; 5°, andesite; 6°, trachyte; 7°, rhyolite; 8°, jaspilite.

If further study shows that other species are needed, then the signification of any of the groups from which the new species are taken can easily be narrowed. As many varietal names can be employed under each species as the needs of the science may demand; but they should be as few as possible, and should hold the same relation to the species that the varietal names of quartz hold to the mineralogical species quartz.

This classification is intended to indicate the probable arrangement of materials in the earth from the interior outwards, beneath the sedimentary formations, as well as to connect, as far as possible, the sedimentary rocks with those from which they were derived.

Meteorites show, to my mind, characters indicating that they have been derived from a hot, liquid mass, and not from any gaseous or solid body, so far as concerns the portion they come from. Of all suggested sources, the most probable one is the sun, provided the eruptive activity now observed on his surface is sufficient to hurl such materials into space; if not now, in past times, when such action was more powerful; or else bodies of similar nature. Meteorites, as far as I have studied them, show no fragmental or tufaceous character beyond such as would be formed by hot, plastic drops falling into a liquid mass of the same material.

They also show that they have not been formed in a locality where life could have existed; for, in that case, the readily alterable materials of which they were composed would have suffered change. M. E. WADSWORTH.

MOLLUSKS OF THE FAMILY COCCULINIDAE.

EXAMINATION of specimens of a Cocculina or an allied genus of that family, from the north Atlantic, shows some remarkable features. These mollusks, recently discovered by the U. S. fish-commission in the deep sea, are most nearly related to the keyhole limpets (Fissurellidae). The specimens obtained by Prof. Verrill, and examined by me, were, however, all females. A number of specimens, of another species, sent me by Dr. Jeffreys for examination, contained individuals of both sexes; and the males were found to possess a verge, permanently exserted from the inner side of the right tentacle. This is a feature hitherto entirely unknown in the order to which they belong, none of the littoral forms of any of the families possessing any such organ; though, like other limpets, dioecious. It is of course probable that the species of Cocculina found by the fish-commission and Prof. A. Agassiz agree in this character with the form from the north Atlantic, about to be described by Dr. Jeffreys; but the latter shows other differences which may require it to be subgenerically separated from Cocculina proper, though evidently a member of the same family. WM. H. DALL.

THE PRESENT CONDITION OF EXPLORATION.

Those readers who wish to follow the reports and news of explorations in distant lands may find some assistance in the following condensed statement concerning the more important recent expeditions in the uncivilized parts of the world. We here note those travellers who have lately completed their field-work, and returned home, and whose narratives are recently published or still awaited; those who are still in the field, from whom occasional reports are received, often only after a time of trying silence; and those who are now planning to enter new ground.

Arctic regions. — The situation of parties in the arctic regions at the beginning of 1883 is about as follows, as far as known. Of the *Jeannette* expedition, the remainder of the original party were about to begin the homeward journey, together with ensign Hunt of the *Rodgers*. At last accounts they were *en route* from Irkutsk to Orenburg. Messrs. Harber and Schutze of the navy were expected at Irkutsk, in April, with the remains of DeLong and his party, intending to start for home as soon as the caskets arrived. A bill has been introduced into Congress to pension Mrs. DeLong; and another to indemnify those who lost personal effects on the arctic expedition of the *Rodgers*, and to reward the friendly natives who preserved the lives of the party during the winter after the burning of the ship. Mr. Leigh Smith of the *Eira* expedition has presented the Geographical society of London with £1,000, in recognition of its interest in arctic work. The arctic exploring vessel *Dimfna*, commanded by Lieut. Hovgaard of Nordenskiöld's party, bound for Cape Cheliuskin or Franz Josef Land, was beset in the Kara Sea, near Kara Strait, in the latter part of August. Several propositions have been made to organize an expedition for the purpose of communicating with her and with the Dutch international meteorological party on the *Varna*, also impeded by ice in the same vicinity. As nearly as can be judged from rather confused telegrams which have been received, no relief-party has actually been organized; though correspondence between the Danish and Dutch authorities has taken place, and the Danish captain Normann has visited St. Petersburg on that business. It has been reported that Larssen, one of the *Jeannette* survivors, had been engaged to make the attempt; and the last news appears to be, that nomads from the Petschora river-mouth report that the vessel was in good order, and had arrived from the coast of Novaia Zemlia to remain for the winter.

The situation at the international polar stations for simultaneous meteorological and magnetic observations was favorable when last heard from, except in the case of the Novaia Zemlia parties. The American station at Lady Franklin Bay, the most northern and the first-established of all, has not been communicated with, owing to ice in the northern part of Smith Sound; but, being fully provisioned and equipped for three years, the party are believed to be in good condition. The German station at Kingava, Cumberland Inlet, was successfully established in the autumn of 1882, under Dr. William Giese. Observations are in progress at Godhaab, in West Greenland, under Lieut. Paulsen's direction. Dr. Snellen in the *Varna*, with the Dutch expedition which aimed at reaching Dickson Haven, near the mouth of the Yenisei, reported beset in the Kara Sea, near Kara Strait, in the last week in August, will doubtless have established a station on the land of Novaia Zemlia if not released by the end of the season. With or near them was the Danish arctic expedition, on the steamer *Dimfna*, commanded by Lieut. Andreas Hovgaard, mentioned above. The Austrian expedition, commanded by Lieut. E. v. Wohlgemuth, succeeded in establishing its station by Aug. 15, on the island of Jan Mayen, in a ravine on the southern slope of the Vogelberg, named Wilczek valley, after the promoter of the expedition. The latest data from the Russian expedition to make a station at the mouth of the Lena was, that all was progressing favorably, and that the party, under the command of Lieut. Juergens, had reached its destination. Of the subsidiary station, projected by the imperial geographical society at Moller Bay, under the direction of Lieut. Andréieff, no positive news has been received here; but it is asserted that they had reached and would winter in Novaia Zemlia. The Finnish station on the shores of the White Sea began operations Aug. 15. Mahlenberg, with the Swedish expedition, were safely established at Wyde Bay, Spitzbergen; while the observations of Steen, at Bosekop, near the North Cape of Norway, have been going on quietly for some time. Capt. Dawson with his party were well on their way toward Fort Rae, in the Hudson Bay territory, when last heard from. The exact locality finally decided upon by the Anglo-Canadian party is not yet known. The U. S. party at U'gla-ámi, near Point Barrow, Alaska, were visited and recruited during the

summer, and the first year's observations are already in the computer's hands; while the simultaneous observations by self-registering instruments under the direction of Mr. Marcus Baker of the U. S. coast-survey, at Los Angeles, Cal., are progressing favorably, and will be steadily maintained. Of the proposed subordinate stations at York Factory and in Labrador, no recent information is at hand, though Dr. Koch, charged with organizing the latter, is stated to have reached Labrador in August.

In the antarctic, parties are believed to be already at work on South Georgia and the Falkland Islands; but details in regard to these stations are not yet received. The French station at Orange Bay, Tierra del Fuego, made a successful beginning of operations Sept. 6.

Alaska. — Little was doing in Alaska at latest advices. A prospector named Bennett, with a small well-armed party provisioned for fifteen months, had entered the valley of the Atna or Copper river to search for minerals. Edward Schieffelin, with his party and steam-launch, reached the junction of the Yukon and Tananah rivers during the summer, and were reported in good condition and spirits, intending to ascend the Tananah and search for gold. After the ordinary means of communication were closed for the season, it appears that discoveries of such importance were made that it justified the expedition of a special courier overland to carry the news to others interested in the venture. The route and details of the journey are not stated; but a letter, apparently authentic, and stated to have been so sent, has been published in the Californian papers, indicating that they had found very rich placers.

The U. S. coast-survey steamer *Hassler* has arrived in San Francisco, after six months' work in Alaska, having made important surveys, and is expected to return to the field in April. Valuable collections were made for the national museum during the voyage. Miners whose movements are not made public are pushing private explorations in many parts of the territory. From the small mining-camp of Juneau, the express companies note the receipt of $240,000 in gold-dust in 1882, against $13,000 in 1881. Capital, which alone can test the permanent value of these discoveries, patiently waits for the long-deferred extension of law and authority over the country by Congress.

South America. — The interior of British Guiana has lately been visited by H. Whitely, who passed near the celebrated mountain Roraima; and by M. McTurk, who travelled up the Cuyuní river toward the Venezuelan frontier. In the valley of the Amazon, R. Payer, brother of the Arctic explorer, was last reported on the Rio Negro, aiming for the Orinoco. J. B. Minchin has executed surveys of the Andean tableland south of Lake Titicaca for the Bolivian government, of which some account has been published; and J. Ball has followed Whymper in visiting the Andes for mountaineering. Dr. Crevaux, who left Buenos Aires Nov. 20, 1881, to ascend the Rio Pilcomayo, was killed there by the Indians in April of last year; but little has been learned of his expedition, and Fontana left Buenos Aires July 4, to search for the remains of the unfortunate party. It is reported that Lieut. Guierre, of the French marine, has undertaken a similar expedition. R. Lista, already successful in Patagonian exploration, is engaged on a journey from Bahia Blanca westward to the Andes, thence southward to Punta Arenas on the Straits of Magellan; and a government commission is occupied with the survey of northern Patagonia, to parcel the land for sale to colonists. Lieut. Bove of the Italian antarctic expedition was wrecked on Tierra del Fuego May 31; his vessel was lost, but the members of the party were rescued by an English vessel. The German south polar expedition was safely left on South Georgia Sept. 3; and the French expedition arrived at Tierra del Fuego on Sept. 6. The several astronomical parties sent to southern South America to observe the transit of Venus will probably return with new geographic observations as well; Steinmann, of one of the German parties, intends making an extended tour through Chili and Bolivia before coming back.

Asia. — The Russians continue an active exploration of their vast dominions. Besides extended surveys in the better-known parts of their country, Elisseieff has been examining Russian Lapland, Ivanitzky has been sent to the Petchora, Malakoff to the Ural, and Walter to Eastern Russia; Poliakoff has recently returned from the island Sakhalin, and Regel is still in the Pamir; surveys are carried on in Caucasia, and along the Persian boundary, where Lessar's recent studies have received much attention. It is proposed to send Preievalski, who has so successfully penetrated central Asia, back to the Tian Shan in March, to study its reported volcanic districts. Capus and Bonvalot, leaders of a French scientific party, have returned from Bokhara; and O'Donovan, an English correspondent, has come safely out of Merv with an interesting experience. Exploration in Asia Minor is largely archeological, and engages Humann,

Hirschfeldt, Fester, and Puchstein, who are aided by funds from Berlin, and Clarke, of our own Assos expedition; and parties from Vienna and from England will probably soon take the field, the latter under Conder to be fitted out by the British association for a survey of eastern Palestine. S. Langer, a young German, who had for some time been studying Arabic in preparation for an inland journey, was killed in southern Arabia last June.

Colquhoun and Wahab have safely finished a journey across country from Canton to Rangoon, where they arrived last July; the latter unhappily died on his way to England. The French are sending many parties into Indo-China, a field that few other nations attempt; Garanger has gone to upper Burma; Villeroi d'Augis has returned from Tonquin, but his companion, Courtin, died in the interior; Harmand has entered Siam; Néis, Aymonnier, Septans and Mondon, and Gautier, have gone to Cambodia and Cochin China, the latter expecting to make an extended journey. C. Bock, known for his travels in Borneo, returned to Bangkok from a trip in upper Siam last June. Riebeck had a successful ethnological tour in northern India, and has gone to Batavia; he will return to Europe by way of this country.

Africa receives the lion's share of modern exploration, and largely with a view to commercial advantage. The French continue their energetic work in Senegambia. Col. Berguis-Desbordes, who was last year in command of a French government party on the upper Senegal, is to return with a strong force to the country between the Senegal and the Niger. A large railway corps under Jacquier will follow him. Dr. Bayol left Bordeaux last October for the Futa-Djallon highlands, and Caquereau was recently preparing a scientific and commercial expedition for the same region. Capt. Burton and commander Cameron returned last summer from the Gold Coast, where they had been to look into the chances of mining. A Russian expedition under Rogozinski, and an Italian under Bianchi and Licata, have been planned to enter the country at the Bight of Biafra. The latter will be absent several years, intending to cross the continent, passing through the unknown region between the Kongo, the Benue, and Lake Tchad, and finally reaching Abyssinia. No full report has yet been made on a similar long journey, but in the opposite direction, by Matteucci and Massari, on the return from which the former unfortunately died in London, August, 1881. Savorgnan de Brazza and Stanley have returned from their expeditions on the lower Kongo; Brazza reaching Europe last June, and Stanley in October. They have unhappily come back with little good-will for each other; and it would seem from the reports of their journeys, so far as yet published, that Brazza has been over-ambitious in his designs. Both are to return for further exploration. In addition to the trading-stations planted on the lower Kongo, several missions have established themselves there, and will probably contribute to our knowledge of the geography of the region. Bentley, Comber, and Grenfell, of the Baptist missionary society, have reached Manyanga and Stanley Pool; Clarke, Richards, Ingham, and Sims, of the Livingston (Kongo) mission, are established at Stanley Pool, and have two small steamboats for journeys up the river; L. Petit, a naturalist who has been along the Loango coast, is going up the Kongo; and Cambier, of the International African association, left Zanzibar last May, with two hundred men, for the Kongo *viâ* the Cape.

From the Egyptian Sudan, Emin-Bey and Lupton-Bey report on their explorations. Among the Italian explorers are Cecchi, lately returned from southern Abyssinia; Count Antonelli, who was to begin his work at the Italian colony Assab, on the Red Sea; P. Sacconi, to establish a trading-station at Harar, southwest of the head of the Gulf of Aden; and Capt. Casati, whom Dr. Junker has met on the Uelle. The latter is still in this little-known region, attempting to solve the problem of its drainage. The German African association at present has several exploring parties at work: Flegel, aiming at Adamaua, with hope of reaching the unknown country beyond between the Benue, Shari, and Kongo; Pogge and Wissmann, who entered from the west coast, and reached the upper waters of the Kongo, where they parted, — Pogge to return westward, and Wissmann to go on eastward to Zanzibar, where he safely arrived last November; and Stecker, who had been with Rohlfs in Abyssinia about Lake Tana, and who then attempted to go southward through the Galla lands to the coast. There is also a German expedition under Böhm, Kaiser, and Reichard, at Kakoma in Ugunda, and a Belgian station at Karema, where Storms has gone to relieve Becker; Dr. G. A. Fischer was to enter eastern Africa from Pangani last November, with an expedition fitted out by the Hamburg geographical society; he hopes to reach Victoria Nyanza, and then turn northward. The appropriation of 100,000 marks by the German Reichstag for African exploration is recently

announced. J. M. Schuver is south-west of Abyssinia, about the head-waters of the Blue Nile. Aubrey and Hamon, Révoil and Soleillet, are French explorers working inward from the Red Sea.

English exploration in the lake region is to be renewed under Joseph Thomson, who is sent by the Royal geographical society to explore Mounts Kenia and Kilimandjaro and the country beyond them. H. E. O'Neill, British consul at Mozambique, has lately undertaken several inland expeditions, and will be probably heard from again. Johnson, of the Universities mission, has recently shown that the Ludjende branch of the Rovuma heads in a lake supposed to correspond to Livingston's Shirwa. Many other missions have stations in the lake region. James Stewart has been sent to construct a road between Lakes Nyassa and Tanganyika. He had a steamer on the former, and has executed a survey of it.

A. Raffray, who had explored part of Abyssinia while French consul at Massaua, has been sent as consul to Tamatave on the eastern coast of Madagascar, where he will probably continue his geographic studies; Paiva de Andrada, with a company of experts, has examined the mineral riches of the lower Zambesi, but no full reports are yet made public; Giraud left Marseilles for Zanzibar last July, hoping to penetrate to Bangweolo lake and then west to the Atlantic; Cardoso and Franco left Mozambique in September last, to enter Umzeila's country; and Dr. Holub intends to return to south Africa early this year, prepared for a journey from the Cape to the Zambesi.

Australasia. — The government of West Australia has sent an expedition, under J. Forrest, to the north-western coast to institute surveys, as he had found valuable agricultural lands there in a previous trip. Michlucho-Maclay, who has spent a year in Europe after his long stay in New Guinea, returns to Sydney to continue zoölogical studies there. While in Europe, he received £2,200 from the emperor of Russia toward the publication of his previous explorations. Last March the Rev. W. S. Green accomplished the ascent of Mount Cook, the highest of the New Zealand Alps, with the aid of two Swiss guides. He proposed to attempt a similar excursion in New Guinea. Dr. Finch has returned from ethnological studies in Australasia and Oceanica. Schadenberg, Meyer, and Landau have been in the Philippines; and the latter goes to Japan. H. de Vésine, Larue, and M. Geny have undertaken an expedition in Sumatra.

As the reports and results of these various explorers are published, it is our hope to present an outline of them to the readers of SCIENCE.

THE WEATHER IN DECEMBER, 1882.

THE monthly weather-review of the U. S. signal-service for December, 1882, shows that the meteorology of the month was of unusual interest. The following may be mentioned as the prominent characteristics: —

The temperature was below the mean in all districts east of the Rocky Mountains, except in the lower Missouri valley, and above the mean from these mountains to the Pacific. The lowest temperature noted was − 35°, in Dakota; and the highest, 95°, in Arizona. The cold was unusual in the southern states, there being frosts as far south as central Florida. The special frost warnings were of great value to the sugar and fruit growers in this section.

The rainfall reports, which were received from over five hundred stations, show in general a deficiency; but there was a marked excess in the northern Pacific district, causing floods in Oregon and Washington Territory. Snow in California on the 12th, causing considerable damage to the evergreen foliage, was the special feature of the precipitation record.

The average pressure was normal; but the depressions, as is usual in December, were well marked, ten being charted. Of these, one was observed from the Pacific to the Atlantic, and across the ocean to the English coast; one was formed by the union of two centres; while two presented the unusual phenomenon of separating each into two distinct centres, which afterwards re-united. Five of the depressions pursued an easterly track, and four a north-easterly. Four of the areas were traced completely across the Atlantic.

The wind velocities were often high; the greatest recorded being 116 miles an hour, at Mount Washington. Velocities of 70 miles were noted on the coast of North Carolina. The following 'total movements of the wind' in miles deserve note: Mount Washington, 23,411; Cape May, 12,901; Pike's Peak, 12,548; Hatteras, 12,279. The velocities at Mount Washington invariably exceed those of any other station, month after month; while those at Pike's Peak are smaller, though the elevation of the station is more than twice as great. In this month the velocity at Cape May, on the coast, exceeded that at Pike's Peak, over 14,000 feet in altitude.

Auroras were frequently noted, but none

were of special interest; earthquakes were reported in New Hampshire and California on the 19th, and in Maine on the 31st.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.

I.

The value to navigation of thoroughly lighting our coasts is too evident to require any argument in its favor; and, in view of the immense interests at stake, there is no question but that improved methods of lighting should be adopted, almost regardless of expense, providing that the advantages gained are in any way commensurate with the cost.

France has long appreciated this; and it is to her that the world owes the Fresnel lens and many improved lamps burning successively whale, vegetable, and mineral oils. She has finally led the way, as usual, in the use of the electric light, which has been definitely adopted for the lighting of her coasts, after many expensive and conclusive experiments; and, when the plan has been fully carried out, France can boast of having the best and most systematic method of coast-lighting of any country in the world.

The United States has followed France. Our optical apparatus has been almost exclusively imported from that country. We use lamps made after French patterns, and now we are making experiments to determine its value for our lighthouses. This is deemed sufficient excuse for giving full details of the French system. The information has naturally been mostly obtained from French sources.

It was in 1863 that the electric light was for the first time used in lighthouses. The experiment was made with an Alliance machine in the first-order lighthouse of la Hève, near Havre; and the results were so satisfactory that doubtless all the lighthouses would have been immediately furnished with electric lights, had it not been for the great expense attending a general alteration. It was proved that the electric light was seen about eight kilometres farther than the oil-light, and that, in time of fog, the range of the former light was more than double that of the latter.

M. Quinette de Rochemont, ingénieur des ponts et chaussées, published in 1870 a report upon the lighthouses at la Hève. Below are some extracts: —

"The electric light having been installed for six years at la Hève, enough time has elapsed to allow us to form an exact idea of the value of this means of producing light for the lighting of coasts. Sailors take pleasure in recognizing the good services rendered them by the electric light. The advantages of the system have been highly appreciated? the increase of the range of the light is very apparent; and, above all, in slightly foggy weather, many ships can continue their voyage, and enter the port at night, which they could not do when oil was used. The light, which at first was rather unsteady, gradually acquired a remarkable fixity, — thanks to the improvement of the apparatus and to the experience gained by the keepers. The fears which were at first entertained regarding the delicacy of certain parts of the apparatus are not realized in practice. The accidents have been rare, the extinctions short and very few, — two only during this period of six years having had a notable duration: one, of an hour, was due to an accident to the steam-engine; the other, of four hours, should, it appears, be attributed to malevolence. Under these circumstances it seems hardly worth while to worry about possible accidents."

Since 1863 experience has only confirmed the favorable views of M. Quinette. The lighthouses of Gris-Nez, France; Cape Lizard, England; Odessa, Russia; and Port Said, Egypt, — have been provided with electric apparatus; and there is a question of placing it in the lighthouses of Planier and Palmyre, France, and in several lighthouses in other foreign countries.

The following information was furnished by MM. Sautler and Lemonnier: —

"When the light is to be fixed, the optical part of the apparatus is composed of a lenticular drum of proper form, which renders the rays horizontal in the vertical plane while allowing them to diverge in the horizontal plane. The dimensions of this drum vary from a diameter of half a metre for a fourth-order light to one metre in a first-order light. This increase in diameter of the apparatus is sensibly proportional to the increase in diameter of the carbon-pencils between which the voltaic arc is produced, and which determines very nearly the dimensions of the electric light. It follows from this, that the vertical divergence remains the same in the different types of apparatus. When the light is to be revolving, the fixed lens is surrounded by a movable drum formed of straight vertical lenses of which the form varies according to the characteristics desired to be given to the light."

Revolving electric lights have this great advantage over revolving oil-lights: the flashes can be given a duration equal to that of the eclipses. In oil-lights, when the light is concentrated in the form of flashes, there are two ends in view: 1°, to augment the intensity, and consequently the range, of the light; 2°, to create an appearance different from that of a fixed light. The first can only be obtained by giving the flash a duration much shorter than that of the eclipse; or, in other terms, by making the angle of the luminous beam a small part of the angle subtended by the lens. Moreover, this angle depends on the dimensions

of the *foyer*,[1] and it can only be augmented either by increasing this dimension or by changing the focal distance of the lens, thus losing a part of the light, since the divergence is produced not only in the horizontal plane, — the only one in which it is utilized for prolonging the flashes, — but in every direction. With the combination of vertical lenses and a cylindrical drum which serves to produce flashes when electricity is used, the divergence of the beams can, by giving the vertical lenses a proper curvature, be augmented as much as desired in the horizontal plane, and the duration of the eclipses be diminished in proportion, while the range of the smallest electric light used will nevertheless remain much greater than that of the most powerful oil-light.

For example: the luminous intensity of an annular panel of 45° of a first-order revolving light with a six-wick lamp equals 9,847 carcels. This is the greatest intensity obtained with an oil-lamp. The divergence of the beam given by this same panel is 7° 7′, and the duration of the flash is about one-sixth part of the eclipse which precedes and follows it.

By applying the methods of M. Allard to the photometric measurements of electric lights, it is found that the luminous intensity of a fourth-order electric light, with a lens half a metre in diameter, and fed by a small model Gramme machine, equals at least 20,000 carcels; and when concentrated by means of straight movable lenses in beams having a divergence such that the durations of the eclipses and flashes shall be the same, its intensity will be equal to 40,000 carcels: that is to say, that it will be four times more intense than that of the most powerful oil-lamp, and with a much shorter duration of eclipse.

By means of electricity such immense quantities of light are produced, that it is not necessary to take into account more or less beams in order to augment the range; the only object of the movable lenses being to produce characteristic appearances which distinguish clearly each lighthouse from its neighbor. These characteristic appearances, the method for producing them, and the system now adopted in France, will be mentioned farther on.

The different lights which serve for the lighting of French coasts are designed so as to answer the different needs of navigation; and their importance varies in consequence according to the rôle they are called upon to play, of which the most important is that of signalling to navigators their approach to land: and the lights constructed for this end are placed in preference upon more or less advanced headlands; which form, according to the expression of M. L. Reynaud, "the angles of a polygon circumscribing all dangers." These are the lights which should have the greatest luminous power, and which, therefore, constitute *first-order lights*.

Between these extreme points indicating the general contour of the coast, the latter still presents advanced points which should become centres of lights of less importance, and serve to guide the vessels to their harbors. The secondary lights placed on these points are called *second-order lights;* and merit their name, not only by their position, but also on account of the less power given to their optical apparatus. Along the route thus traced for navigation are also found localities which it is important should be pointed out to sailors: these are, for example, sand-banks, sunken rocks, islets, etc. From these arises the necessity of luminous *foyers* of various intensities, and the creation of *third-*, *fourth-*, and *fifth-order*, and of even less powerful, *lights*, such as are placed in harbors on the end of jetties, to show vessels the entrance to the channel.

In addition, among all the lights of different orders, some, placed on an island, are designed to throw their light entirely around them; others, built on an advanced promontory or established on a straight part of the coast, only send their rays on a fraction, more or less great, of the zone which surrounds them; finally, others only have to light a determined point: hence the distinction of lights in *lights of all the horizon*, *of three-fourths the horizon*, *of two-thirds the horizon*, etc.

Until 1863 all the lights of the French coasts were furnished with apparatus for oil; and it was not until this epoch that there was installed, at one of the two lights of la Hève, the first apparatus for lighting by electricity. After a year and a half of experiment, the result having been most satisfactory, it was decided to light in the same way the second light of la Hève; and, about two years later, the electric light was also placed in the lighthouse at Cape Gris-Nez. Matters remained in this condition until within the last few years; and, while England counted on her coasts six electric lights, the three which we have just mentioned were the only ones in existence in France. Lately, the reconstruction of the light-house of Planier having been

[1] The French word *foyer* means literally a *hearth, a place where something is burnt*, and, in the sense used here, *the source of light and heat*, — the *space occupied by the flame of a lamp or by the electric arc*. The word is so useful that I take the liberty of using it in place of an English paraphrase.

judged necessary, it was decided to use the electric light in it; and the same decision was taken regarding the lighthouse of la Palmyre, whose luminous intensity was recognized as insufficient.

But the good results given by the electric light at la Hève and at Cape Gris-Nez called attention to the more general service it could render; and on the 27th January, 1880, after a long study of the question, M. Allard, director of the French lighthouse department, presented to the minister of public works an important report, recommending the general adoption, upon the whole extent of the French coasts, of electric lighting. This report was approved on the 4th December, 1880, by the Conseil général des ponts et chaussées; and the principle of electric lighting has just been adopted for the entire extent of the coast. This decision was so important that it seems proper to mention here the principal points of M. Allard's report, to make known the arguments brought to the support of using the electric light, and the results obtained in various trials, and, finally, to give details of the electric installations of this nature actually in use.

Before mentioning the considerations in favor of changing oil for electricity, we must speak a few words on the range of lighthouses. The *range* is the distance to which the light is visible at sea; the *circle* of range has this distance as a radius, and the light as a centre. The range of a light depends not only upon the optical conditions in which the light is placed, but also upon its height above the level of the sea. Thus there is a distinction between the *geographical range* and the *luminous range;* the latter being the one under consideration. It increases with the transparency of the atmosphere, which is very variable, and changes with the locality; thus, on an average, it is much greater on the Mediterranean than on the south-western coasts of France, greater on the latter than on the shores of Brittany, and becomes the least in the British channel. Moreover, the transparency varies according to the seasons; and there are, during the year, a certain number of more or less foggy days, during which the transparency of the air and the range of the light are both diminished. It is impossible, therefore, to fix the range as a certain quantity; and it is necessary to establish a mode of designating the varying range. To do this, observations are made during the year on the variations of the range; the foggiest nights are then omitted, and the minimum range for the remainder of the year represents the range for that portion of the year. If, for example, thirty nights, or one-twelfth of the year, are deducted, and, during the remainder of the year, the smallest range is twelve nautical miles, it is considered that the light under consideration has a range of twelve miles for eleven-twelfths of the year. In short, the range of a light during a portion of a year is the distance at which it is always visible during that portion.

In order that the lighting of coasts be efficient, it should be continuous, so that a vessel sailing along the coast, as soon as it passes the range of one light, should come within that of the next; in other words, that the *circles* of range should cut each other successively. With the system of oil-lights now in use, this is actually the case, but only during half the year: during the other half, the oil-lamps have not sufficient power. It will be very different when the electric light is used. The ranges will be increased, and the circles of ranges will cut each other during eleven-twelfths of the year.

The accompanying outline map, Fig. 1, shows what would be the ranges if the electric lights were used, supposing that each light had a mean intensity of 125,000 carcels. The dotted lines show the present ranges with oil-lamps. When the electric light is adopted, the range of the new lights will be 27.7 nautical miles in the Mediterranean for $\frac{14}{15}$ of the year, 19 to 21 miles in the British channel for $\frac{10}{12}$ of the year, and 22 to 26.5 miles on the Atlantic coast for the same period.

If the increase in the range, by using the electric light, is a powerful consideration in favor of this system, objections may, however, be made on the score of economy. The report of M. Allard shows that the expense of executing the entire programme, even including the installations of steam-sirens, will not exceed $1,600,000; which is very reasonable compared with the results obtained. Besides, the cost of maintenance of electric lights is not, as one might have supposed, much greater than that for oil-lights. Thus the annual expense of a first-order oil-light is about $1,660 per year; while for each electric light-house at la Hève the cost is $2,270, and for that of Cape Gris-Nez $2,680. If it is desired to compare the cost of a unit of light for a lighthouse lit by oil with one lit by electricity, it is found that the former costs $81 per unit, while the latter is $22 at Cape Gris-Nez, and $19.40 at la Hève.

It should be said here, that there is only

taken account of, in the above figures, the light of the *foyer* itself, independently of the optical apparatus; which, by concentrating the rays, augments the intensity very considerably.

The number of electric lights comprised in the project is forty-six, counting as two the double lights of la Hève, of la Canche, and other; and, where there is a gap, it will be filled with an oil-light. This map also gives the distinctive characteristics of the different lights, and this is a most important point to be considered.

In a good system of coast-lights, the neighboring lights should have very distinctive

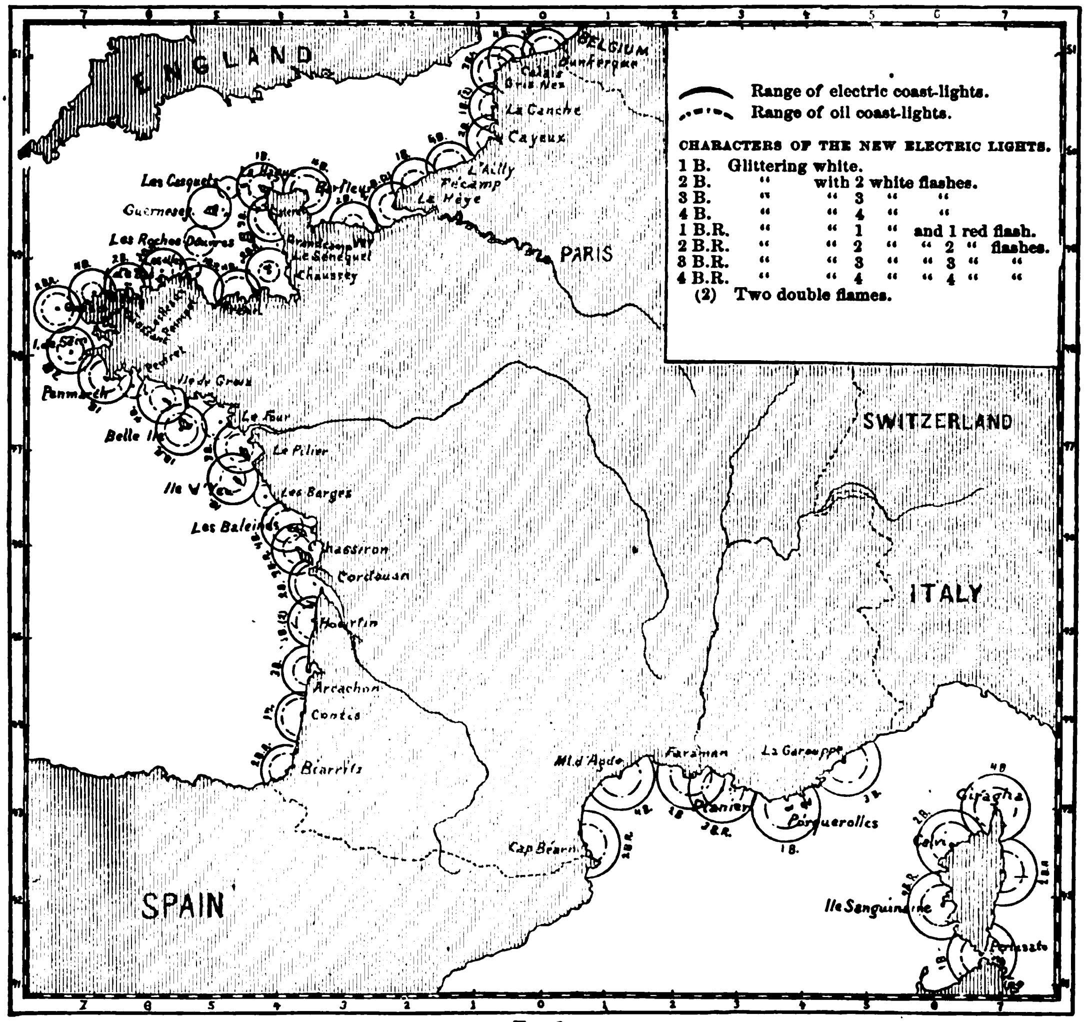


FIG. 1.

of Hourtin. Of this number there are thirty-eight of the first order, two of the second order, five of the third order, and a new one to be placed at the south of Paimpol. Four of these lights are already, or are about to be, lighted electrically.

As to the distribution of the lights, it is easy to follow it upon the map, Fig. 1: almost everywhere the circles of ranges cut each characteristics, in order to avoid all possible confusion. In the existing system, these conditions obtain; and the first idea which naturally presented itself was to retain the old characteristics, simply substituting the electric for the oil light, so that there would be no change from that to which sailors were accustomed: but the existing characteristics are, in some ways, inconvenient, and it has been de-

cided to replace them by others; which, by making the lights more easy to be distinguished, will, besides, increase the range.

The present characteristics are as follows: —

1. A single fixed light.
2. A double fixed light.
3. An eclipsed light, with flashes every half-minute.
4. An eclipsed light, with flashes every minute.
5. A fixed light varied by flashes every four minutes.
6. A fixed light varied by red flashes every four minutes.
7. A light with alternate red and white flashes.

Fixed lights are obtained with a Fresnel apparatus with cylindrical lenses; the double fixed light, by two lights situated at such a distance that they can easily be distinguished from each other, but still appear to form a pair. Fixed lights will eventually disappear, because they have a less range than flashing lights, and also are liable to be confounded with other fixed lights not belonging to a system of coast-lighting.

Flashing lights are obtained by means of optical apparatus having generally eight faces: each face comprises, first, a lens of the same width as the face, then, above and below, portions of rings having as a common centre the centre of the lens. The apparatus thus gives rise to eight beams of light, separated by dark intervals; and, when it is turned, the navigator sees alternately a flash and an eclipse. The intervals between the flashes depend upon the rapidity of rotation. This light has the inconvenience of requiring sustained attention, and of consulting a timepiece to tell the length of the interval. It should be suppressed.

The fixed lights varied by flashes are obtained by means of an apparatus for a fixed light around which turn two or three vertical lenses which give flashes, either white or red, or alternately white or red, at intervals of some minutes. These slowly revolving lights have the same fault as the preceding, and will also eventually disappear.

The characteristic which will be generally adopted is that of a *scintillating* light. To produce it, a fixed-light apparatus is employed, around which revolves a drum of lenses, placed vertically, composed of straight glass bars of lenticular cross-section; each of these concentrates the horizontal rays, and consequently produces a flash. During a rotation, if all the lenses are alike, the navigator will see a series of equal white flashes, producing a scintillating light. If the vertical lenses are alternately red and white, there will be alternately a red and white flash, and a compound red-and-white scintillating light will result. In the same way, by placing the lenses in groups, there can be two, three, four, or more white flashes, followed by a red one. It should be remarked, that, in this case, as the red color diminishes the luminous intensity, the red lens should have larger dimensions to compensate for this loss: as this causes a loss of light, M. Allard prefers, in most cases, to separate the group of white flashes simply by an obscure interval. This is obtained by a simple modification in the form of the vertical lenses. There are thus the following eight characteristics: —

1. White scintillating light.
2. Light with alternate red and white flashes.
3. Light with two white flashes and one red successively.
4. Light with three white flashes and one red successively.
5. Light with four white flashes and one red successively.
6. Light with two white flashes, with intervals of obscurity.
7. Light with three white flashes, with intervals of obscurity.
8. Light with four white flashes, with intervals of obscurity.

These are the only characteristics which have been definitely adopted. They have the advantage of being readily recognized without consulting a timepiece.

LETTERS TO THE EDITOR.

The new comet in Pegasus.

I DESIRE to give publicity to the following statement regarding the priority of discovery of the new comet in Pegasus. I discovered it at seven o'clock last evening; and, as soon as the direction and rate of motion was ascertained, I repaired to the telegraph-office (a mile away), and telegraphed its discovery to several astronomers, and to Professor Pickering to cable to Europe. In journeying thither I must have passed the messenger-boy with a telegram from Mr. W. R. Brooks of Phelps, N.Y., which I found at the observatory on my return, announcing to me his discovery of the same object.

It was then too late to undo the mischief I had innocently done. In fact, I was not even then sure that there was any guilt attaching to the transaction, as he did not give the time of discovery. He immediately wrote, however, giving the time as forty-five minutes past six, local time, which letter reached me to-day.

I consider it my duty to give to the world the above facts, that no injustice be done to Mr. Brooks. No instance occurs to me of a comet having been discovered by two persons so nearly simultaneously.

The comet is quite bright, with a strong central condensation, though no nucleus could be detected. Its tail was about 40′ in length, faint, straight, and narrow.

The shutter of the dome of the observatory is undergoing some slight repairs, which prevented the use of the 16-inch refractor; and I was, in conse-

quence, unable to obtain its position except by estimation.

At twenty minutes past seven I estimated it to have been in about R. A. 22 h. 57 m., Dec. + 29° 50′, as determined by comparison with Argelander's charts, no allowance for precession being made. It was 2° 37′ almost exactly north of Beta Pegasi, as roughly determined by the size of the field of my comet eye-piece. Its motion is slowly eastward, probably north-east; but its altitude was so low, and the hour being so near moonrise, I could not determine its exact direction.

It presented a beautiful appearance through my 4½-inch achromatic. Lewis Swift.

Warner observatory, Rochester, Feb. 24.

Movement of the arms in walking.

In Science, Feb. 9, Mr. F. W. True recognizes the 'movement of the arms in walking' as a functional relic of quadrupedal locomotion; urging thereby a modification of the expression of Professor Dana, sanctioned by Dr. Gill, that "man stands alone among mammals in having the fore-limbs not only prehensile, but out of the inferior series, the posterior pair being the *sole* locomotive organs." And the questions are asked, "Have we not at least a ghost of a preexisting function? Does man walk by means of his feet and legs alone?" Viewing the question from the developmental standpoint, it seems to me that the strongest evidence appears in the first locomotor-acts of the child. Before bipedal progression is learned, *the child goes on all-fours, and is an actual mammalian quadruped.* At the beginning of this the prehensile power of the fingers is very imperfect. Men have been known to educate their toes to do more than the fingers can at that stage of functional development. At that time the palms are of more value as soles than for holding things. In the beginning, also, the arms in some children are better legs than are the hind-limbs, being more easily used. For example, it is more common for children to creep on the knees than on the elbows; but some learn remarkably early to elevate both knees and elbows, to creep on the soles and palms. My own boy walked on his soles and palms from the start, and never upon his knees. The speed with which he finally learned to run in this way was remarkable. After learning to move somewhat on his hind-legs, when he got in such haste as to make bipedal balancement difficult or uncertain, he would take to all-fours, thereby making better speed with less danger of a fall.

U.S. dept. of agric., Washington, Feb. 13, 1883. W. S. Barnard.

The heart as a locomotive organ.

Every one has observed that the tendency of the heart to beat while walking 'is a most natural one.' 'The action is rhythmical,' the number and force of the pulsations varying with the velocity of the walk. 'It is also involuntary;' but, although proper locomotive movements are usually in a high degree *voluntary*, this consideration need cause us no uneasiness, if we reflect, that, when its action is from any cause suspended, 'an air of stiffness' is soon imparted to the whole body.

In view of these facts, does it not seem that the statement (Science, p. 11) that "man stands alone among mammals in having the fore-limbs not only prehensile, but out of the inferior series, the posterior pair being the *sole locomotive organs*," should be further modified, and the heart assigned its proper place between the swinging arms as a *true* locomotive organ? O. Harger.

New Haven, Feb. 28.

The copper-bearing rocks of Lake Superior

There are one or two statements in Mr. Selwyn's remarks on the age of the rocks on the northern shore of Lake Superior, in the number of your journal for Feb. 9, which I cannot suffer to pass unchallenged.

I cannot enter here into a general discussion of the much-vexed question of the age of the Lake Superior copper rocks, — I have discussed it at length elsewhere,[1] — but I must take issue with the statement that there is "no evidence whatever of their holding any other place in the geological series" than that which "includes the Potsdam and Primordial Silurian." My own conclusions in this connection, after an examination of most of the circuit of Lake Superior, are: —

1°. That the copper-bearing rocks underlie unconformably — and with an immense unconformity — a series of sandstones holding Cambrian fossils. These fossils may not correspond to the oldest Cambrian fossils known elsewhere, as argued by N. H. Winchell in the report quoted, but they are distinctly Cambrian; and if the copper-bearing strata are to be called Cambrian, then we must stretch that term over a most immense unconformity, in order to include a rock-series holding no fossil evidence of its Cambrian age, — a thing which appears to me very unreasonable to do. This unconformity is best seen in the St. Croix river region of western Wisconsin, and thence north-eastward. Although attention was drawn some years since by Sweet, Chamberlin, and myself,[2] to the strikingly conclusive occurrences of this region, our evidence has been ignored by others who have never examined the region, and who continue to approach the question from the eastward, or, in other words, from the same direction as a succession of geologists, from Houghton to Selwyn, all of whom have felt baffled. It is interesting to note in this connection that N. H. Winchell, the only geologist who has gone to the St. Croix since our report was issued, confesses to the unconformity,[3] although he had strenuously refused to believe in it before visiting the region. It does not seem to me that any geologist can honestly deny this unconformity until he has done as we have done; viz., followed the copper-bearing strata, with all their characters preserved, mile by mile, from the typical region of Keweenaw Point, to their junction with the fossiliferous Cambrian sandstone of the St. Croix valley.

2°. That the copper-bearing strata also underlie unconformably the 'eastern sandstone' of the south shore of the eastern half of Lake Superior. Winchell has argued a difference of age between this sandstone and that of the St. Croix valley. However this may be,— and I have myself seen no evidence that the one of these sandstones is not merely the direct downward continuation of the other, — the work done by myself and assistants along the contact line of the copper-bearing rocks, and the eastern sandstone from Bête Grise Bay westward to the vicinity of Lake Agogebic, has served to convince me that there is here also an unconformity as great as the other.

3°. That the time-gap between the copper-bearing series and the Huronian was too long to allow of our classing them together, — for it certainly covered a considerable amount of denudation and alteration, — but it is still doubtful if this gap was long enough to cover the folding of the folded Huronian. The greatest confusion prevails as to the use of the term Hu-

[1] The copper-bearing rocks of Lake Superior, — vol. v., monographic publications of the U. S. geol. survey; also Third annual report of the same survey. Both of these publications are still under press.

[2] Geology of Wisconsin, vol. iii.

[3] Loc. cit., p. 134.

ronian. The Canadian geologists have fallen into the custom of calling every thing Huronian that is schistose, and yet it is evident that much of the schists called by them Huronian are but dependencies of the older gneiss. I may say in this connection, that the 'Animikie group' of Thunder Bay, which Selwyn, following Logan, refers to the copper-bearing series, is, beyond question, the exact equivalent of the unfolded iron-bearing rocks of the Penokee region of Wisconsin, and these again of the folded iron-bearing schists of the Marquette and Menominee regions; and that there can be little doubt that all of these are the equivalents of the original Huronian of the north shore of Lake Huron. This reference of the Animikie rocks to the Huronian is, I know, a novel position, although Logan long since for a time held the same view; but I feel confident that it is a correct one. Indeed, I speak confidently as to all of the conclusions here mentioned, because I have had unusual opportunities for observation, having studied both the Cambrian sandstones and the copper-bearing rocks, as well as the Huronian from Keweenaw Point across Wisconsin, into Minnesota, and thence north-eastward to Thunder, Black, and Nipigon Bays. Having made this wide sweep, I can see quite well how others, examining only portions of the district, should be puzzled or reach different conclusions.

There is one other statement in Mr. Selwyn's letter that I cannot concur in; and that is as to the occurrence of tuffs, or volcanic detrital matter, among the copper-bearing rocks. I know such materials should be expected to occur in a series largely composed of volcanic flows; but after a careful search for them in the field, and the study of a large number of thin sections, I can find no fragmental rocks which are not either certainly ordinary sediments or at least much more probably so than of direct volcanic origin.

Madison, Wis., Feb. 16, 1883. R. D. IRVING.

WHITNEY'S CLIMATIC CHANGES.

The climatic changes of later geological times: a discussion based on observations made in the Cordilleras of North America. By J. D. WHITNEY. Cambridge, 1882. 14+394 p. 4°.

I.

THIS volume is one of a series, by the same author, based on the work of the California geological survey, but published under the auspices of the Museum of comparative zoölogy. The preceding volume treated of the auriferous gravels of California, and this one is in some sense a sequel to it. Although the treatise is an outgrowth of the Californian work, its material includes observations by the author in eastern America and in Europe, as well as data gathered by others from all regions. It is of interest, not only by reason of its contribution of original matter, but because it develops at length a theory that has heretofore been stated but briefly, and which has been almost ignored by the advocates of its rivals. The book comprises four hundred quarto pages, but is without index, — an omission only imperfectly supplied by an analytic table of contents.

In the volume on the Auriferous gravels, our author states that the Sierra Nevada has had substantially the same height and dimensions from cretaceous time. The streams which flowed down its western flank during the tertiary did not excavate gorges, but, on the contrary, spread great bodies of detritus. The modern rivers, following essentially the same courses, have cut deep V-shaped cañons, which were partially filled with ice during the glacial epoch. The tertiary climate was relatively moist, as is shown by the broad channels of the tertiary rivers, and by the fact that they filled their valleys with gravel instead of cutting cañons.

In the present volume, the idea of a diminution of precipitation from pliocene to present time is expanded into a theory of general, continuous, secular desiccation, and is developed at length. Evidence is adduced to show, that within historic time there has been a shrinking of lakes and rivers in South America, in the interior basin of Asia, and about the shores of the Mediterranean; and that, in late geological time, large areas in northeastern and northwestern Asia and northern Africa were covered with water, while the Great Basin of North America contained a system of freshwater lakes. The ancient glaciers of the Sierra Nevada, and of the Cordilleras generally, are described; and their disappearance is referred to the same desiccation. An account is given of the tertiary lakes of western North America, and it is pointed out that their extent gradually diminished. The popular theory that modern desiccation is due to the destruction of forests, and the theory of some geologists that the great lakes and rivers of the immediate past were connected with the melting of the ice of the glacial epoch, are controverted; and it is argued that all the phenomena pertain to a general, secular diminution of precipitation.

To account for this diminution, the following considerations are adduced: The amount of moisture precipitated to the earth depends on evaporation. The amount of evaporation depends on temperature and on the extent of water-surface. If, therefore, it can be shown that the continents of the earth have gradually increased in area, while the oceans have gradually diminished, or if it can be shown that the temperature of the atmosphere has gradually lowered, then an explanation will be afforded of the change in precipitation. After a review of the facts, Professor Whitney concludes that an expansion of continents has actually taken place, but that it is inadequate to account for the observed recent desiccation. He therefore bases his theory chiefly upon a loss of heat,

adopting the doctrine of the dissipation of solar energy, and citing the paleontologic evidence of warm tertiary climates in arctic regions.

Search is made for proofs of recent changes of temperature corresponding to the recent changes in precipitation. The thermometric record is rejected, because the conditions of observation have not been constant; but certain circumstantial evidence is admitted. The northern limit of the grape and other cultivated plants is observed to be now farther south than formerly, and the northern limit of human habitation has been crowded somewhat southward. The people of Greenland and Iceland are emigrating, and icebergs are multiplying in arctic waters.

This theory of the continuous fall of general temperature is evidently inconsistent with the prevalent assumption that the glacial epoch was a period of exceptional cold, and a considerable share of the book is devoted to the setting-aside of that assumption. To this end the present glaciation of the earth is reviewed at some length, and the conditions of glacier formation are discussed. It is shown that mere cold, whether it pertain to high latitude or to high altitude, is not sufficient, but that an abundant precipitation must accompany it; and, since a lowering of general temperature tends to check precipitation by checking evaporation, it should not be predicated as the cause of the glacial epoch. A higher general temperature is quite as likely to be a favorable condition for producing the demonstrated effects.

For a series of decades there has been a general shortening of the glaciers of the Alps, the Caucasus, and the Pyrenees. In some localities the retrograde movement began about fifty years ago; in others, twenty-five; and the longer glaciers have receded several thousand feet. This is ascribed to a slight diminution of precipitation, caused by the general cooling of the atmosphere, and is correlated with the desiccation of the shores of the Mediterranean.

The phenomena of the glacial epoch are then reviewed; and it is stated that only in western Europe and north-eastern America was the glaciation so extensive as to demand the assumption of conditions considerably different from the present. The environments of individual glacier districts are discussed, and the prevalent ideas with reference to the magnitude of the phenomena of the glacial epoch are combated.

In particular are the phenomena of Greenland, Scandinavia, and the Ural contrasted. Precipitation is now small in the district of the Ural, large in Scandinavia, and probably large in Greenland. This accounts for the extensive glaciation of Scandinavia and Greenland, and the absence of glaciers, both ancient and modern, from the Ural. The present conditions of Scandinavia and Greenland differ chiefly in that the latter is somewhat higher and more maritime; and to account for the ancient extreme glaciation of Scandinavia, it would be natural to suppose that it then resembled Greenland in these respects. According to the Swedish geologists, this was the case. Its altitude was greater, and during at least a portion of the glacial epoch the plain at its eastern margin was submerged.

The description of the glaciation of north-eastern America is somewhat meagre, and is chiefly characterized by a tendency to estimate lower than other geologists the magnitude of the phenomena. The existence of an ice-sheet is not denied; but the difficulties attending the glacial hypothesis are emphasized, and great importance is attached to the work of icebergs and rivers.

Incidentally the book is replete with illustrations of the independence of the author's opinions. He ascribes no erosive power whatever to glaciers, but refers the multitudinous rock basins of Canada and Finland to chemical decomposition and orographic displacement, and asserts that the tendency of streams is to deepen these basins rather than obliterate them. He has a theory of glacier-motion in which water plays an important part; and he ridicules the idea that different layers of a confluent ice-mass can move in different directions. The statement that most, if not all, of the detrital material of north-eastern North America is destitute of any true morainic character, will sound strange to the geologists who are now studying the moraines of that region.

In a succeeding number some of the author's more comprehensive conclusions will be discussed.

THE GOVERNMENT AGRICULTURAL REPORT.

Report of the commissioner of agriculture for the years 1881 and 1882. Washington, *Government printing-office.* 1882. 704 p., 84 pl. 8°.

INASMUCH as the present commissioner, when he entered upon his duties, "found the work for the season, both regular and special, elaborately laid out by my [his] successor," his report not unnaturally bears a strong resemblance to the reports of preceding years. It

contains the usual reports of the entomologist, the superintendent of grounds, the botanist, the chemist, and the statistician, besides special reports relating to the diseases of animals and to the boring of artesian wells on the arid lands of the west. The tone and matter of the special reports and of the reports of special character compare so favorably with most of those of the old-style 'regulars,' that the thought suggests itself, that a much larger proportion of the work of the department than has hitherto been customary could best be done by special commissioners outside of Washington and far away from its influences. From the very nature of the situation and surroundings of the Department of agriculture; the irregularity of its income; and its dependence for support upon the favor of political parties, — let alone the merciful dispensation that the tenure of office of its chief is short, — it cannot be accounted competent to carry on continuous scientific researches; and it is in no sense desirable that it should do so. Works of *longue haleine* such as must necessarily run on consecutively from year to year are beyond its powers; and it will be well for Commissioners of agriculture, present and future, to accept the fact. Rather than try to grasp the unattainable, it will assuredly be wiser to study special finite questions as they present themselves; and to this end the best means is the employment of special scientific men of approved competency, each one to grapple with his own particular question in such place and manner as he may deem fit.

One commendable feature of the present volume is the comparative brevity of the reports of the superintendent of grounds and the botanist (of the report of the entomologist we shall speak at another time). The report of the chemist, on the other hand, is extended, and it has somewhat the effect of a twice-told tale. It was interesting and important to prove that the proportion of true sugar in sorghum-stalks increases continually until the plant is well advanced toward maturity; but the evidence of this fact presented in previous reports seemed convincing, and many of the results recorded in the present volume have the effect of being little more than refinements upon good work. The reader is inclined to ask whether it is not about time for the department to let its scientific corps drop sorghum, and to relegate the subject to the artsmen proper; that is to say, to those farmers and manufacturers who are specially interested in this line of business.

From a letter of the 'commissioners for locating artesian wells upon arid and waste lands,' as well as from the statements of the commissioner of agriculture himself, it appears that in their opinion the first trial-well at Fort Lyon in Colorado was not a success. The onus of this 'failure' is made to rest, of course, on the shoulders of a preceding administration; but the lesson it teaches is none the less instructive. It suggests the reflection, that while one important function of the Department of agriculture has been to show the American people 'how not to do it,' there are various ways in which the lesson is enforced. Impracticable borings in Colorado undoubtedly represent one mode of tuition, but in the appointing and changing of employés for political reasons we have another; and to the same end must inevitably work all changes of base which are hasty, spasmodic, and inconsequent. It will be of interest to notice how far down the next borings will be permitted to reach before a new incumbent says, 'Hold, enough!'

From a couple of modestly printed tables on pp. 25 and 692, it appears that the Department of agriculture disbursed $256,129.68 during the year ending June 30, 1881, and $353,748.60 during the year ending June 30, 1882. It will convey no new information, either to scientific men or to the agricultural community, when we say that the results obtained by this class of expenditures have hitherto been, out of all proportion, small.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

The polar quadrilateral. — As a geometrical interpretation of a property of the roots of an equation of the fifth degree, A. Brill shows that the six points in which a conic circumscribing a triangle can be made to osculate a fixed conic are the same for certain five triangles connected with a polar quadrilateral of the fixed conic. — (*Math. ann.*, xx. 331.) C. L. F. [288

Ruled spaces. — In a thesis presented to the Sorbonne, M. Koenigs studies the infinitesimal properties of an extensive class of linear complexes, basing his researches upon the earlier investigations of Plücker, Kummer, etc. M. Koenigs observes, that in punctual space, tangential space, and in space of which the sphere is an element, every infinitesimal property is expressed as a property of involution. He commences by defining certain primordial elements which he regards as necessary and sufficient for the expression of all mutual relations of the infinitesimal prop-

erties of ruled spaces. He defines a point a, and a plane α through this point, as a *couple*, which he indicates by the symbol (a, α). Among the ∞^2 couples situated upon a straight line A (i.e., the point a lies on a straight line A, which is itself contained in the plane α), there is a simple infinity satisfying a given condition; their aggregate constitutes a *correlation*. If this condition consists in the equality of the anharmonic ratios of the four points and the four planes of four arbitrary couples of the correlation, the correlation is said to be *anharmonic*. An important application is made of a theorem of Chasles', concerning the distribution of the tangent planes to ruled surfaces. If $u_1\ u_2\ u_3\ u_4$ are parameters upon which depend a knowledge of a right line (u), and $u_1 + du_1$, etc., those which refer to an infinitely near line $(u + du)$, the vanishing of a homogeneous function of the differentials du expresses a property of the system of lines (u) and $(u + du)$, and, consequently, of the correlation which they determine relatively to one of the group (u). The differentials du, or finite quantities t proportional to them, may be considered as homogeneous co-ordinates of the different anharmonic correlations existing upon the line u. Among these correlations those which destroy one or two kinds of t-co-ordinates constitute, respectively, a *plexus* or a *series* of correlations. These plexi and series replace the cones of elementary directions in punctual space. The condition for the meeting of two lines (u) and $(u + du)$ is expressed by the vanishing of a quadratic form $\mathrm{N}(du)$; and, obviously, all forms such as $\mathrm{KN}(du)$, where K is only a function of the variables u, express the same property. The author remarks that it is possible to choose K in such a manner that the resulting form shall represent the moment of the two lines: i.e., the product of the shortest distance between them by the sine of the angle of their mutual inclination. A number of analogies are here given with punctual spaces. The author makes use of a theorem of Sturm's, concerning pencils of lines; and, particularly, of a method of Darboux', referring to the linear representation of surfaces. A special system of co-ordinates is examined, in which the linear complex possess the properties of spheres; and from this is deduced a system analogous to pentospherical co-ordinates, of which the Plückerian coordinates and Klein's sextuply-orthogonal system are particular cases.

The third part of the memoir refers entirely to infinitesimal properties of the second order. The problem treated is an extension of the theory of geodesics, and conducts to a geometrical interpretation of Lipschitz' *normal co-ordinates*. — (*Bull. sc. math., etc.*, 1882.) T. C. [289

PHYSICS.

(*Photography.*)

Photographic halos and reversals. — When a brilliant point of light is photographed, we often find that it is surrounded by a black circle on the negative, whose inner edge is distinctly marked, while its outer shades off imperceptibly into the surrounding regions. Capt. Abney shows that this is not a diffraction phenomenon as has been asserted, but is due to reflection from the back surface of the glass; and that the diameter of the ring depends on the thickness of the glass, and on its critical angle of reflection. All trouble from halos may be avoided by coating the back of the plate with Brunswick black, which reflects back no light to the film.

It is a well-known fact, that, if we greatly over-expose a plate, we shall get a reversal of the image, — the lights taking white, and the shades black, instead of *vice versa* as usual. Now, it has been shown that this is due to the action of the bromine, which has been freed in the lower layers of the film by the action of light, and rises, attacking the metallic silver and sub-bromide in the upper layers. This difficulty is avoided by soaking the film in a solution of potassium nitrite, which absorbs the bromine as fast as it is formed, and before it can do any damage. — (*Brit. journ. phot.*, Jan. 5.) W. H. P. [290

Keeping-qualities of gelatine plates. — Mr. William Brooks has been making some experiments on the keeping-qualities of gelatine plates, and finds, that, though they may work well for a few months, they become slower after that time, the images thinner, and that they develop a tendency to fog. Emulsions were made up with the different silver salts: and it was found that plates coated with the pure bromide of silver would keep well for six months; those coated with bromo-iodide would keep four months; those with bromo-chloro-iodide, three months; and bromo-chloride, two months. The latter plates gave by far the best results when new; but unexposed plates very soon deteriorated, especially if the weather was damp. — (*Brit. journ. phot.*, Feb. 2, 1883.) W. H. P. [291

Lead as an intensifier. — Herr Grebner recommends the following intensifying solution: nitrate of lead, 4 parts; potassium ferricyanide, 6 parts; water, 100 parts. When this solution has acted sufficiently long upon the plate, it is taken out and washed; it is then placed in a mixture of one part of a saturated solution of potassium chromate, and five parts of ammonia, after which it is washed for a short time. If washed too long, the film has a tendency to peel. This formula is applicable to collodion plates. — (*Brit. journ. phot.*, Feb. 2, 1883.) W. H. P. [292

Electricity.

Determination of the ohm. — G. Lippman proposes to measure the resistance of a column of mercury by opposing the current induced by a rotating magnet to another current measured by a galvanometer. Then

$$r = \frac{2\pi n m \mathrm{K}}{\mathrm{K}'\mathrm{H}\tan\alpha};$$

where K is a constant of the electro-magnetic apparatus, m the moment of the magnet, n its velocity of rotation, K′ the galvanometer constant, and H the horizontal resultant of local magnetic forces. $\frac{m}{\mathrm{H}}$ is determined by Gauss's method. The author claims, that in a resistance of one to five ohms the fractional error would be within $\frac{1}{1000}$. — (*Comptes rendus*, xcv. 23.)

Another method, by the same author, is to revolve a coil inside of a bobbin which carries a current passing through the resistance to be measured. The current induced in the revolving coil is opposed to the difference of potential at two points in the resistance to be measured. The condition of equilibrium is $r = 2\pi n \mathrm{C\,S}$, where n is the velocity of rotation, S the distance between the points of contact, and C a constant of the bobbin. The author gives an experimental method of finding S′, the value which S would assume if the bobbin were extended to infinity in both directions. The value of C for such a bobbin is $4\frac{\pi}{d}$, d being the distance between two turns of the wire. — (*Comptes rendus*, xcv. 26.) J. T. [293

Aërial navigation by electricity. — M. Gaston Tissandier has found that an electric motor of the Siemens pattern, driven by a bichromate battery, the whole not exceeding the weight of three men, is

capable of furnishing regularly for three consecutive hours the work of twelve to fifteen men. A balloon of 900 cub. m. capacity could raise in the air such an apparatus with the additional load of two or three men. M. Tissandier is now engaged in the construction of a gas-generator; after this is completed, he hopes to construct an elongated balloon to which he can apply his machinery. — (*Rev. électr*, Jan. 27. 1883.) J. T. [294

Cost of electric lighting. — Dr. Siemens, in his address to the London society of arts, showed that arc-lamps were cheaper than incandescent lamps, and that both would be decidedly cheaper than gas-lighting if the electric companies had the opportunity to make sufficiently large plants, and the gas companies continued to pay their present large dividends. — (*Rev. électr.*, Nov. 25, 1882.) J. T. [295

New electric lamp. — Mr. Charles Lever of Manchester has invented and patented an electric lamp in which the carbons are held apart by a spring when no current is passing. The current, when first started, excites an electro-magnet which releases a clip, and allows the upper carbon to fall upon the lower; the weakening of the magnets consequent on shunting the current through the carbons allows the spring to bind the clip, and draw back the upper carbon to the proper distance. When the carbons burn away so as to increase the resistance greatly, this process is repeated. — (*Rev. électr.*, Jan. 6, 1883.) J. T. [296

Electric torpedo-boat. — A torpedo-boat has just been satisfactorily tried at Constantinople, in which a Siemens electro-motor drives two screw propellers in the rear of the boat. The vessel is cigar-shaped, and moves under water at the rate of eight knots an hour. Its path is traced in the day-time by a wire which projects above the surface, and is followed by a telescope; in the night, by a lantern having an opening only towards the shore, and a light too feeble to betray itself to the enemy by reflection. The place in which the torpedo-boat was tried furnished a severe test on account of the strong currents, which vary in direction in different parts of the channel, and in strength from one part of the day to another. The wires conveying the explosive discharge are, of course, distinct from those carrying the motive current. — (*L'Électricité*, Jan. 6, 1883.) J. T. [297

Electro-magnetic theory of light. — J. W. Gibbs continues his mathematical treatment, obtaining in this paper as the general equation of monochromatic light in a medium of any degree of transparency: —

$$\frac{4\pi^2}{p^2} Pot\,[\mathrm{U}]_{Ave} - \nabla\,[q]_{Ave} = \Phi\,[\mathrm{U}]_{Ave} + \Psi\,[\dot{\mathrm{U}}]_{Ave},$$

where Φ and Ψ denote linear and vector functions; *Pot*, the operation by which the potential of a mass is derived from its density; q, the actual potential; U the electrical displacement; and p, the period of the luminous disturbance. The symbol $[\;]_{Ave}$ denotes a space-average taken through a sphere of unit radius concentric with the point considered. This treatment removes certain objections to the electro-magnetic theory raised by Lorentz and Rayleigh. The equation, however, is not claimed to be rigorously general. — (*Amer. journ. sc.*, Feb., 1883.) J. T. [298

Planetary induction. — M. Quet considers the magnetic induction of the planets on the earth, and obtains

$$\frac{\mathrm{F}}{\mathrm{F}_1} = \frac{\mathrm{R}_1{}^2\,\mathrm{V}\,\mathrm{N}\,p}{\mathrm{R}^2\,\mathrm{V}_1\,\mathrm{N}_1\,p_1}\sqrt{\frac{\cos^2 u - 3h^2h'^2 - 2hh'\cos u + 4h^2}{\cos^2 u_1 - 3h_1{}^2h'^2 - 2h_1h_1'\cos u_1 + 4h_1{}^2}};$$

where F and F_1 represent the forces which Jupiter and the sun, for instance, exert on the earth, V the volume, N the angular velocity, p the magnetic power, u the angle of the magnetic axis with the axis of rotation, h and h' the cosines of the angles which these two axes make with the radius vector from the earth's centre. — (*Comptes rendus*, xcv. 23.) J. T. [299

Distortion of the spark by statical electricity. — M. Aug. Righi argues, that the spark of a disruptive discharge ought to be acted upon by neighboring statical charges, as if the spark were a body electrified to the same sign as the electrode whose electric density before discharge is stronger. Experiments in which one electrode of a Holtz machine is connected with the earth, and also where one electrode has a greater curvature than the other, confirm his conclusions. — (*Comptes rendus*, xcv. 24.) J. T. [300

ENGINEERING.

Regulation of rivers, and prevention of floods. — A valuable report upon the rectification of the Rhine and Danube has been made by M. Gustave Wex, privy councillor to the emperor of Austria, in which an account is given of the work carried on between Mannheim and Basle during the period from 1819 to 1863, by which the distance has been shortened from 252 to 169 kilometers, and the fall increased by thirty per cent. The stream has moreover been confined to a uniform channel, the banks being carefully protected, and the old bed with its branches filled, and the land thus reclaimed brought under cultivation. Government considers that the benefits from the change are so large as to make ample payment for the outlay. Similar work upon the Danube has been in progress from 1869 to 1881. The author concludes, that from 48 years of observation and experience of extensive works undertaken for the improvement of rivers, it can be confidently stated that by careful study, even the most tortuous rivers and the swampiest valleys can within a few years yield the most satisfactory results. — (*Van Nostrand's eng. mag.*, Feb., 1883.) G. L. V. [301

The preservation of timber. — A committee of eight members of the Amer. soc. of civil engineers has made a preliminary report upon the above matter, in which a list of thirty-three different chemical processes is presented for preserving wood from decay. The census of 1880 has shown the need of a far more economical use of timber in this country than has prevailed heretofore. Not less than a thousand circulars were sent out to civil engineers, railroad-superintendents, dealers in timber, and chemists; and numerous letters from engineers are given, in regard to the duration of wood under various conditions. — (*Trans. Amer. soc. civ. eng.*, Oct., 1882.) G. L. V. [302

New harbor at Vera Cruz, Mexico. — The plans of Mr. James B. Eads for a new and extensive artificial harbor at Vera Cruz have been for some time before the engineering world, and the work was commenced last autumn. The natural harbor is exposed to gales from the north and north-west, and is often made very dangerous during storms. The plan of Capt. Eads provides for a quiet harbor with deep water and suitable lights for guidance of shipping. The cost of the above works is reckoned at about ten millions of dollars. — (*Engineering*, Nov., 1882.) G. L. V. [303

CHEMISTRY.

(Organic.)

Dianilido-phosphorus hydrate. — Professor Jackson mentioned a Dianilido-phosphorus hydrate $(C_6H_5NH)POH$, which he and Mr. Menke had obtained by the action of phosphorus trichloride upon aniline. The crude product formed by adding

phosphorus trichloride to aniline was heated over a free flame in a porcelain dish, and the orange-yellow product boiled with alcohol. On adding water a white precipitate of the above composition was thrown down. This substance is not acted upon by aqueous potassium hydrate nor by dilute sulphuric acid, but it is decomposed by strong nitric acid. — (*Harvard chem. club; meeting* Jan. 9.) [304

Phenoxybromacrylic acid. — Professor Hill described phenoxybromacrylic acid which he had obtained by acting upon mucobromic acid with potassium phenolate, and treating with potassium hydrate the product thus obtained. He proposed to study it more carefully with the hope of establishing the relative position of the bromine atoms in mucobromic acid and the connected dibromacrylic and dibrommaleic acids. — (*Ibid; meeting* Jan. 23.) [305

(*Analytical.*)

Quantitative determination of calcium. — Dr. Kinnicutt gave an account of some experiments which he had undertaken with Mr. F. G. Short on the quantitative determination of calcium. Calcium oxalate is precipitated highly crystalline from a boiling solution if it is cooled rapidly, and it may be filtered immediately. In the separation of calcium and magnesium, the calcium oxalate may be filtered without standing, if the formation of an ammonio-magnesium oxalate is prevented by using a small excess of ammonium chloride and by cooling rapidly after precipitation. — (*Ibid.*) [306

Estimation of sulphur in illuminating-gas. — A method proposed by O. Knublauch consists in burning a known volume of the gas, mixed with air, in a glass tube, and absorbing the sulphuric and sulphurous acids in a solution of potassium carbonate. After oxidation of the sulphurous acid with potassium permanganate, the sulphur is calculated from the weight of barium sulphate obtained by precipitation with barium chloride. For details of the method, and description of the apparatus, reference is made to the original article. — (*Zeitschr. anal. chem.*, 1882; also *Berichte deutsch. chem. gesellsch.*, xv. 2403.) C. F. M. [307

Volumetric determination of copper, iron, and antimony by the processes of M. F. Weil. — If a standard solution of stannous chloride is added to a boiling solution of cupric chloride containing sufficient free hydrochloric acid to impart to it a yellow color, complete reduction of the copper solution is indicated by disappearance of the color. A solution of ferric chloride also is rapidly reduced by stannous chloride. In each case the final re-action is so clearly marked that no other indicator is required. When cupric chloride is added to a solution of antimonic chloride in an excess of hydrochloric acid, the mixture acquires a greenish-yellow color. If the quantity of copper is known, by deducting from the volume of tin solution required to reduce the mixture the volume corresponding to the copper, the difference represents the volume of stannous chloride required to reduce the antimonic to antimonious chloride. Copper, iron, and antimony may be determined in the same solution by a combination of these methods. After each series of determinations the tin solution must be restandardized. — (*Revue des mines, Chem. news*, 46, 284.) C. F. M. [308

AGRICULTURE.

Availability of nitrogenous fertilizers. — To obtain an approximate idea of the relative value of different nitrogenous substances as fertilizers, Stutzer and Klinkenberg propose to digest them with an acid solution of pepsin, and determine the proportion of nitrogen soluble in this reagent. They find that a definite proportion of the nitrogen is entirely unacted upon, as Stutzer has previously shown to be the case with fodders; and this portion they consider of little value as a fertilizer. — (*Journ. für landw.*, 30, 363.) H. P. A. [309

Fineness of superphosphates. — In pot experiments with finely ground superphosphate and with the same substance artificially granulated, Wagner finds the former decidedly superior. — (*Biedermann's central-blatt*, 1882, 665.) H. P. A. [310

Clover sickness. — A particular case of 'clover sickness' has been investigated by Kutzleb. It was shown that the failure of the clover was not due to parasites, to lack of nitrogen, to lack of water, or to unfavorable physical properties of the soil. An analysis of the soil showed a decided deficiency of easily soluble potash (soluble in carbonic-acid water), especially in the subsoil, in comparison with the soil of neighboring estates on which clover flourished; and the clover sickness is attributed by the author to this cause. No attempt appears to have been made to test the effect of manuring the field in question with potash. — (*Biedermann's central-blatt*, 1882, 728.) H. P. A. [311

Seed-testing. — Ad. Mayer and Van Pesch suggest various unimportant modifications in the methods of seed-testing in general use in the seed-control stations of Germany. Nobbe comments on these suggestions. A subsequent paper by Nobbe treats of the method to be followed in testing the sprouting power of beet-seed, and of the best manner of expressing the results. — (*Landw. versuchs-stat.*, xxviii. 167, 283.) H. P. A. [312

GEOLOGY.

Induration of rocks by atmospheric action. — Dr. M. E. Wadsworth gave some observations, made in 1871–73, upon the effect of atmospheric action in indurating the friable St. Peters and Potsdam sandstone in Wisconsin. This effect was quite strongly marked upon the exposed surfaces, resulting in induration, the partial obliteration of the granular structure, the formation of concretions, and even of quartz crystals; while the covered portions of the same blocks and slabs retained the usual friable character. — (*Bost. soc. nat. hist.; meeting* Feb. 7.) [313

Glacial phenomena of Mill Rock near New Haven. — Prof. W. P. Blake spoke of the low east-and-west ridge just north of New Haven, and referred its existence to the intrusion of trap-rock in the form of a narrow vertical dike, a part of the East-rock dike. It presents a precipitous front to the south; but northwards the slope is gentle, and is formed of sandstone. This dike of hard trap, and the adjacent hardened sandstone, stood up like a wall in the path of the great glacier; and its surface is strongly rounded off, grooved, polished, and striated by the ice. This cutting is best seen on the surface of the hard sandstone. The direction of the glacier appears to have been from the north-east. In addition to the glacial scratches, there is a series of transverse valleys or depressions having about the same direction. These appear to have been formed by the ice following the lines of outcrop of the harder beds of sandstone underlaid by soft red shales.

Heavy bowlders of hard trap are irregularly distributed in sandy gravel on the north slope. There are some large bowlders of quartz, but granite bowlders do not occur. Most of the bowlders have flattened sides, showing extensive abrasion. They are generally ellipsoidal in form, and are often broken at one

end. The quartz bowlders are found in forms which indicate that they were firmly held in the ice, first in one position, then in another, some of the smaller masses having several facets. A great variety in the nature of the soil is observed. There are deposits of clean sand and of bowlder-clay. These peculiarities, and the abraded bowlders, indicate the *moraine profonde*, or under-moraine. The large pot-holes cleanly cut in the sandstone of the north slope are referred by Prof. Blake to glacial origin, being similar to the 'giants' kettles' of the glaciated regions of Norway, and formed, probably, by vertical torrents falling through the ice-sheet. — (*Conn. acad. arts and sc.; meeting* Jan. 17.) [314

MINERALOGY.

Minerals of the cryolite group. — A note that several minerals of this group, occurring in small quantity, have been identified from a locality near Pike's Peak, Col., by W. Cross and W. F. Hillerbrand of the U.S. geological survey, is of interest. — (*Amer. journ. sc.*, Oct., 1882, 281.) S. L. P. [315.

Vesuvianite. — Crystals from Kedalbék (Eastern Caucasia), rich in planes, and brilliant, have been chemically and crystallographically examined. The results of analysis agree closely with the accepted formula $H_2R^{II}_6R^{IV}_4Si_7O_{29}$. Four planes new to the species were identified. — (*Zeitschr. krist.*, vii. 344.) S. L. P. [316

Humite. — As the result of the crystallographic study of this mineral from Ludugrufvan (Sweden), Hj. Sjörgren has shown its analogy to the crystallized humite from Vesuvius, though the number of occurring planes is much smaller. The associations of the mineral from this locality is very similar to that occurring at Brewsters, N.Y.; the humite, associated with magnetite, calcite, and brucite, occurring from pure, through all stages of decomposition into serpentine. The pure, unaltered crystals were mostly found imbedded in calcite. In thin sections under the microscope, the appearance is almost identical with that of olivine. The author entering into a discussion of the chemical composition of this, and the closely allied minerals clinohumite and chondrodite, states that the presence of water in all these minerals has often been noted; and, although it fails to appear in most of the published analyses, there is, in most cases, a deficiency of constituents given, in order to make up the full 100 per cent; and this deficiency increases as the quantity of fluorine decreases. Provided this deficiency is due to undetermined water, it might be taken to indicate, that, where there is a deficiency of fluorine, a univalent hydroxyl group enters into the mineral as an isomorphous replacement of a part of the fluorine. Taking this into consideration, and also the varying ratios of Si : R (R=Mg and Fe), he finds that the three minerals agree closely with the following formulae, arranged so as to show their relation to one another and to olivine: olivine, $Mg_{12}\,[SiO_4]_6$; clinohumite, $Mg_{10}\left[Mg\left(\begin{smallmatrix}OH\\F\end{smallmatrix}\right)\right]_4[SiO_4]_6$; humite, $Mg_9\left[Mg\left(\begin{smallmatrix}OH\\F\end{smallmatrix}\right)\right]_6[SiO_4]_6$; chondrodite, $Mg_8\left[Mg\left(\begin{smallmatrix}OH\\F\end{smallmatrix}\right)_8\right][SiO_4]_6$. These formulae are derived principally by calculation from the older analyses; and it is hoped that more exact analyses may be made to clear up more fully the true chemical nature of these minerals. — (*Zeitschr. krist.*, vii. 344.) S. L. P. [317

Rezbanyite. — Under this name, a new mineral resembling cosalite ($2\,PbS$, Bi_2S_3), but with varying composition, has been described by A. Frenzel. It occurs along with other bismuth and lead minerals at Rezbanya, Hungary: structure, massive, with no decided cleavage; lustre, metallic; streak, black; hardness, 2½–3; gravity, 6.09–6.38. Three independent analyses were made, which led to the formula $4\,PbS$, $5\,Bi_2S_3$. — (*Min. und petr. mitth.*, v. 175.) S. L. P. [318

Alloclasite. — This mineral, which occurs at Oravicza (Hungary) in small crystals resembling mispickle, has been newly investigated by A. Frenzel, and shown to be in composition also closely related. On account of the rarity of the crystals, enough of them could not be obtained for analysis; but several analyses from specimens of massive material were made which agreed nearly with the formula (Co Fe) (AsBi) S. It varies from mispickle in that most of the iron has been replaced by cobalt, and part of the arsenic by bismuth. — (*Min. und petr. mitth.*, v. 179.) S. L. P. [319

METEOROLOGY.

Thermal belts of North Carolina. — Professor J. W. Chickering read a paper on this topic, reciting the observations of Mr. Silas McDowell and others. The valley of the Little Tennessee river, in Macon county, is about 2,000 feet above tide. When the thermometer indicates a temperature of about 26° F., the frost extends about 300 feet in vertical height up the mountain-sides, and there ceases, appearing again 400 feet higher. In the intervening belt, the most delicate plants remain untouched; and so sharp are the dividing-lines, that sometimes one half of a shrub may be frost-killed, while the other is unaffected. Following a tributary stream upward from the valley, one passes three mountain-barriers, and enters in succession three valleys, the highest of which is plateau-like, and 3,900 feet in altitude. The vernal zone appears in each valley, rising as the valleys rise, but somewhat less rapidly; so that in the highest it is only 100 feet above the plateau. In this frostless zone the Isabella grape not merely has ripened for twenty-six consecutive years, but is free from mildew, blight, and rust. In Polk county a similar belt is said to skirt the Tryon mountain, extending from 1,200 to 2,200 feet above tide. This is untouched by frost until the latter part of December, and is usually free from snow; while the mountains above and the valleys below are covered. The peculiar stratification of the air indicated by these statements merits scientific investigation. — (*Phil. soc. Washington; meeting* Feb. 24.) [320

GEOGRAPHY.

(*Asia.*)

Riebeck in India. — Dr. Riebeck writes, that after returning with rich collections from Darjiling to Calcutta, where an industrial exhibition gave him opportunity to procure many specimens, he went to Chittagong, and secured in a relatively short time photographs and face-casts of twelve different hill-tribes. A famine in the hill country had driven the suffering people into the British territory, not with any warlike designs as had been reported, but simply to obtain food, mostly rice from the government stores. The poor people often came from twenty-five days' journey beyond the British boundary, and many of them had never seen Europeans before. — (*Verh. gesell. erdk. Berlin*, ix. 1882, 504.) W. M. D. [321

Regel in central Asia. — Dr. Regel reports a number of new geographic details to the Russian geographical society from the region of Karategin and Darwas, about the sources of the Amee River.

The climate is clear and dry in summer; but in the long winter there are heavy snowfalls, preventing communication between the villages. On the way eastward to Karategin, he crossed three nearly meridianal mountain ranges. South-east of the Wakish, the ranges run north-east and south-west; and after crossing the Pandj (Pandsch), the great Badakshan range is fully parallel to the Hindu-Kush. The Wakish, Pandj, and Wandj rivers are respectively 100, 100–170, and 60–100 metres broad. The natives regard the latter two as the true head-waters of the Amee. They both have turbid water, and in winter carry cakes of ice. There are no bridges over the Pandj, and the stream is crossed on goat-skin floats. The population of these villages is very mixed: some of the tribes seem of true Aryan type. For the last fifty years the country has been desolated by wars, in which the prisoners were carried off to be sold as slaves at Buchara, Kashgar, and Badakshan. — (*Verh. ges. erdk. Berlin*, ix. 1882, 505.) W. M. D. [322

(*Africa.*)

New expeditions for eastern Africa. — The geographical society of London has given Mr. Joseph Thomson command of an expedition to enter eastern Africa from Zanzibar, with the object of exploring a direct route to the eastern shores of Victoria Nyanza, and examining Mount Kenia. Thomson left England on Dec. 13. He has previously led two expeditions in this region with excellent success, and a good share of scientific results. He is now preceded in the field by Dr. G. A. Fischer, for whose expedition the Hamburg geographical society has appropriated 15,200 marks. Fischer was to leave Pangani last November, and march toward Liconono, then to the south-eastern shore of Victoria Nyanza, and the little-known Baringo Lake, and, if possible, to go on farther north. Parts of this region have been specially studied by German explorers: Erhardt, Krapf, and Rebmann, in 1848–49; v. d. Decken, Kersten, and Brenner, in 1859 and 1862; Hildebrand, in 1875–77; and Denhardt, and Fischer himself, in 1878. — (*Proc. roy. geog. soc.*, 1883, 32; *Verh. ges. erdk. Berl.*, 1882, 399; *Ausland*, 1882, 978.) W. M. D. [323

Dr. Junker on the Uelle. — This persevering explorer joined an armed Egyptian party a year ago, and followed down the valley of the Uelle, gaining some information about its probable lower course, and returning by a détour to the south and east. It seems that Uelle is simply, as is so often the case, the local word for *river*, and that its name is really Makua; so with its southern branch marked Nomayo on Schweinfurth's map, which should be Bomokandi. Dr. Junker concludes from native information, that the Makua Uelle is the head stream of the Shari; and that the Nepoko, rising farther east and flowing south, is Stanley's Aruwimi branch of the Kongo. He also refers to a large lake south of the region he passed through, and doubtless corresponding to the lake reported from upper Egypt by Lupton; Junker's Makua being presumably the same as Lupton's Bahr el Makwar. — (*Proc. roy. geogr. soc.*, Jan., 1883; *Peterm. mittheil.*, 1882, 424, 441.) W. M. D. [324

BOTANY.

The chromatophor of algae. — While at the zoölogical station in Naples, Prof. Fr. Schmitz studied the arrangement of the coloring matter in the cells of marine algae; and he has since extended his observations to the coloring matter of other groups of plants. At present he gives only the results of his observations on algae, reserving for a future publication his researches on Archegoniata and phaenogams. In a few plants, as the Phycochromaceae, the coloring matter is uniformly diffused through the cell; but in most cases it has a definite outline, and forms a mass to which Prof. Schmitz gives the name of chromatophor. In the higher plants the chromatophor is principally represented by chlorophyl grains; but in algae it is often represented by bands, stellate masses, or large irregularly shaped bodies. Schmitz finds in the chromatophors of many algae more or less spherical bodies to which he gives the name of pyrenoids. They occur in some red and brown algae, and are very common in green algae. Schmitz shows that the chromatophors of algae are capable of division, and that new chromatophors are always formed from some already existing chromatophor and not from the protoplasm itself, using the word in its strict sense. In some cases it appears to be the case that pyrenoids which are in reality nuclei of the chromatophors have been mistaken for the nucleus of the cell itself; as in the case of Anthoceras, where it has been generally supposed the cell nucleus was surrounded by an irregular mass of chlorophyl. — (*Verhandl. natur. vereins Rheinl. u. Westfalens*, 1883.) W. G. F. [325

American Characeae. — The manuscript of the late Alexander Braun, of Berlin, has been edited by Nordstedt, who has added notes and observations of his own; and the whole forms the most complete monograph of the Characeae yet published. In it appear for the first time in print descriptions of several American species which were hitherto only known from herbarium names. The monograph includes one hundred and forty-two species and sub-species. — (*Abhandl. acad. wiss. Berlin*, 1882.) W. G. F. [326

The relations, as regards size, of the wood-cells in Coniferae and other trees. — Dr. Ewald Schulze has repeated the extensive observations of Sanio, and has obtained results which appear to confirm them. He has further shown, that the principles laid down by Sanio may be extended to a much wider range of ligneous plants. — (*Zeitschr. f. naturwiss.*, 1882, no. 3.) G. L. G. [327

Relations of organic matters in the soil to the process of assimilation in the sugar-beet. — The old experiments have been repeated and extended by Corenwinder, but have added very little to what was known before. He states, however, that the beet, when cultivated in a soil very rich in carbonaceous matters, can absorb more or less carbon from that source. As to the use which is made of this carbon, he is unable yet to express a positive opinion; so the question has not been materially affected by his present work. — (*Comptes rendus*, Jan. 2.) G. L. G. [328

Detection of adulterations in tea. — Mayer calls attention to the peculiar character of the felted hairs on the leaves of certain Camellias, and to the universal occurrence of firm cells, which are almost true sclerenchyma, in the parenchyma of the under side of the leaves of tea. The cells are said to be best seen when thin sections of soaked leaves are first treated with dilute potassic hydrate, afterwards washed with alcohol of 50% which contains 10% hydrochloric acid, and finally placed in glycerine and water. — (*Zeitschr. f. naturwiss.*, 1882, no. 3.) G. L. G. [329

(*Fossil plants.*)

Laminarites Legrangei. — Saporta reviews the characters and conformation of this species, described formerly by Saporta and Marion in their work on the Evolution of the vegetable kingdom, p. 101, f. 34. Nathorst of Stockholm had considered it as representing the tracks of animals. From better, very large specimens, Saporta has seen it composed of bands or

lamellae closely placed, and crossed at right angles by others apparently superimposed and of the same nature. He has been able, by separating the layers composing the thallus, to see that these bands anastomosed at their points of conjunction, leaving between them empty spaces of the same width as the bands, composing a kind of latticed thallus like that of species of Agarum. — (*Comptes rendus*, June 26.) L. L. [330

Permian plants from eastern Russia. — After giving a vertical section of the upper Permian of Kargalinsk, Twelvetrees describes a Cardiopteris, two species of Walchia, one Lepidodendron, one Schizodendron, one Anomorrhoea, a Caulopteris (?), and four Calamites. These plants have, taken altogether, a remarkable analogy with a group of vegetable remains procured from strata near Fairplay, Col., and which, by their characters, are of lower Permian age. The affinity is rendered the more remarkable by the fact, that, as remarked by the English author, "The list of the species of plants has a paleozoic aspect, but a secondary one as respects the reptilian remains." The same can be said of fossil remains of Fairplay, the plants being all of paleozoic types; while the insects, according to the researches of Mr. Scudder, are mesozoic. — (*Quart. journ. geol. soc. Lond.*, no. 152.) L. L. [331

ZOÖLOGY.

(*Geographical distribution.*)

The relations of the 'nearctic' region. — A re-examination of Wallace's palaearctic and nearctic regions is being made by A. Heilprin.

Two propositions are discussed: namely, 1°, whether the nearctic region is entitled to independent rank? and, 2°, if not, to which of the two regions, neotropical or palaearctic, does it belong. For the mammals, Wallace's tables are recast. It is shown, that, while eighteen neotropical and nineteen palaearctic families occur in the nearctic region, only eleven genera are common to the nearctic and neotropical regions, as opposed to twenty-one genera common to the latter region and the palaearctic. The number of genera peculiar to the nearctic region amounts to 35 per cent; to the palaearctic, 35 per cent; to the oriental, 46 per cent; to the Australian, 64 per cent; to the Ethiopian, 63 per cent; and to the neotropical, 78 per cent. The number of families peculiar to the nearctic is given as one; to the palaearctic, none; while all the remaining regions have from seven to nine. By uniting the first two regions, the proportion of peculiar genera is raised to fifty per cent, and the number of peculiar families, including Rogiferidae, Alcadae, and Copridae (though without warrant in this case, as it appears to us), to seven, thus bringing the combined regions into rank with remaining divisions of the globe. In conclusion, it is considered proved: "first, that by family, generic, and specific characters, as far as mammals are concerned, the nearctic and palaearctic faunas taken collectively are more clearly defined from any or all the other regions than either the nearctic or palaearctic taken individually; and, second, that by the community of family, generic, and specific characters, the nearctic region is indisputably united to the palaearctic, of which it forms a lateral extension."

It would appear that the first conclusion does not entirely satisfy the first proposition, and that the second conclusion should be reversed; since, according to the percentages given, the palaearctic region is the lateral extension of the nearctic. Among the many thoughts to which the paper (which is not yet completed) gives birth, the following may be recorded: 1°. Even after combining the two northern regions, the interval between their percentage of peculiar genera and that of the region having the next higher number is greater than that between percentage of the palaearctic region alone and that of the region having the next higher number. 2°. The number of families peculiar to the combined regions, according to Wallace's tables (excluding the ungulate subfamilies), is but one more than the number of families peculiar to the nearctic region alone according to Allen's tables. 3°. The character of the peculiar families inhabiting the Australian region is very different from that of those of the other regions, since in the former case six of the eight families belong to one order, while in the latter the families are divided among the many orders of Monodelphia. 4°. A knowledge of what regions are occupied by a group of animals is of more importance to the zoölogist than the knowledge of what animals occupy any region or regions; especially if, in the latter case, no account is taken of extinct forms. — (*Proc. acad. nat. sc. Philad.*, 1882, 316.) F. W. T. [332

(*General physiology and embryology.*)

Action of digitaline on the circulatory organs (preliminary note by H. H. Donaldson and L. T. Stevens). — The continuation of the experiments begun last year has yielded the following results: the work done by the heart of the common frog is decreased by digitaline, whatever the dose, as was previously shown to be the case for the heart of the 'slider' terrapin. In both frog and terrapin, the decrease occurs, whether the aörtic valves are intact or not. Variations in arterial or venous pressure do not affect the result.

By a method permitting direct measurement of the fluid circulating through the viscera and lower extremities in a unit of time and under constant pressure, it has been determined for the frog that the arterioles are constricted by digitaline. On this point the terrapin has not yet been investigated. Digitaline has also been shown to increase mean blood pressure in both frog and terrapin.

We have, then, for the frog under digitaline a decrease in the work done by the heart, a rise of mean blood pressure, and a constriction of the arterioles. The first and second of these points have been already demonstrated for the terrapin as well. — (*Johns Hopk. univ. circ.*, Feb., 1883.) [333

Origin of the heart. — Professor Bütschli has advanced a hypothesis of the phylogenetic origin of the heart and blood-vessels, which has much plausibility. He suggests that the heart is a remnant of the primitive or segmentation cavity of the embryo, and is not derived from the secondary or permanent body cavity (schizocoele or enterocoele). He endeavors to reconcile this view with the accounts of the development of the heart in vertebrates, maintaining that it probably arises as a fissure in the mesoderm, remaining as a permanent part from the temporary primitive cavity. More support for the hypothesis is found in arthropods; for it has been observed in several forms that the two edges of the mesoderm approach one another in the median dorsal line, leaving a space between them, which belongs to the primitive cavity. This space becomes the heart. Sometimes it is cut off before, sometimes after, the mesoderm is split into segments. These observations were upon the bee (Bütschli), Geophilus (Metschnikoff), and Branchipus (Claus). An investigation to answer the problem propounded by Bütschli would, it may be safely said, prove fruitful and interesting. — (*Morph. jahrbuch*, viii. 474.) C. S. M. [334

Mollusks.

Anodonta fluviatilis. — Dr. Jos. Leidy directed attention to a basketful of living fresh-water mussels, Anodonta fluviatilis, collected from ponds in the marl of New Jersey. He had found them on examination to be exceedingly prolific. The pregnant females have the branchial uteri, as they have been appropriately named by Dr. Isaac Lea, enormously distended with perfected embryos. These appear with a cinnamon-brown shell having a conspicuous spinous tooth or hook to each valve, and are provided with long byssal threads. Wishing to ascertain the proportionate amount of embryos, the following calculation was made: in an individual six inches long, the soft parts were weighed, and found to be 135.44 grammes. The branchial uteri weighed 64 grammes, and the inner gills 7.34 grammes. Supposing the latter to be of the same weight as the outer gills free from embryos, this weight subtracted would leave 56.66 grammes as that of the embryos, and 78.78 grammes as the weight of the rest of the animal. He estimated that there are 1,280,000 young in the branchial uteri of each animal.

The mussels were infested with many water mites creeping about among the gills, and the young of the same were found embedded in the mantle. The mite appears to be identical with the Atax ypsilophorus described one hundred years ago by Bonz, as infesting the Anodonta cygnea of Europe. It is of a dense black color, with a Y-shaped yellow mark on the back. Our Unio complanatus had been found infested with a mite which is probably the Atax Bonzi described by Claparede from European unios. If our parasitic mites are identical with those of European mussels, it not only makes it appear probable that they are of common origin, but renders it the more probable that this is likewise the case with their hosts, even if these are not regarded of the same species. — (*Acad. nat. sc. Philad.; meeting* Feb. 13.) [335

Insects.

Luminosity of fire-flies. — Considering the popular interest in the subject, we have very few investigations of the light-giving organs of insects; but for all this, as the latest student of their anatomy, Heinrich Ritter v. Wielowiejski, observes, there are plenty of contradictory statements.

The photogenic organs, as Huxley calls them, consist of thin whitish plates, resting on the ventral walls of the penultimate and antipenultimate abdominal rings of the abdomen, which is in these spots transparent to allow the emission of the light. In the female glow-worm there are also two small accessory light-organs in the last ring. These photogenic plates are composed of 'parenchymal cells,' richly supplied with nerves and tracheae. The upper and lower strata of the plates, considered as distinct by former authors, really differ only in the nature of the contents of the parenchymal cells above and below. These cells are morphological equivalents of the 'fat-body' (as maintained by Leydig), and physiologically are glandular. The production of light results from the slow oxidization of materials formed, under control of the nervous system, by the parenchymal cells. The light may continue to shine long after the death of the cells, and therefore is not a property of the living protoplasm as such.

The stellate 'terminal tracheal cells' discovered by Schultze have no connection with the production of light, nor are they the ends of tracheae. They belong, in fact, to the matrix, or peritoneal sheath, of the tracheae, which is spread out about the point where the fine tracheae branch into still finer 'tracheal capillaries,' which latter want the spiral threads of the tracheal stems. The 'capillaries' seldom end blindly, but anastomose with each other into a sort of network. They do not penetrate into the parenchymal cells, but seem to run over their surface, twining irregularly around them on all sides. Some (or all ?) of the parenchymal cells are connected with fine nervelets.

The most useful reagent for the study of the light-organs was a solution of osmic acid (from 1 to 0.1 per cent) in which the living insects were immersed, and later transferred to alcohol, or to a mixture of alcohol, glycerine, and water.

The eggs were found not to shine by their own light, but as stated by Newport, though he has been contradicted by Owsjannikow, are sometimes rendered luminous by an accidental coating of the luminous substance of the light-giving organs, which might easily be ruptured by the pressure of the masses of eggs contained in the abdomen of a gravid female.

While the luminosity of the adult fire-flies is evidently useful in bringing the sexes together, it remains to explain the luminosity of the larvae and pupae, which are thus of course made conspicuous to the eyes of insectivorous birds and other animals. Von Wielowiejski suggests that their bite, already known to be poisonous to the snails on which the young fire-flies feed, is to some extent poisonous to the enemies of the latter. If this is the case, or if, as it may be suggested, they are disagreeable to the taste, the light would of course serve as a danger-signal to protect its givers from attack.

The author finally calls attention to larval or embryonic characteristics found in adult Lampyridae. Besides the well-known larval form of the adult female glow-worm, the 'terminal tracheal cells' are embryonic structures. There is also the occasional occurrence, on the muscular fibres, of remains of the embryonic formative cells, and the presence of the large free cells in the body cavity.

The paper appears to be the result of careful and reliable study, and, if somewhat diffuse, is still a most valuable contribution to our knowledge of a difficult subject: it contains, besides the points already mentioned, a number of observations on the fat-body, nervous system, cuticula, etc. — (*Zeitschr. wiss. zool.*, xxxvii. 354.) E. B. [336

VERTEBRATES.

Integumentary appendages. — Mr. J. A. Jeffries spoke of the structure of these parts in birds, and compared these with each other and the appendages of other vertebrate groups. Having stated that the same layers of the epiderm could be found in the development of all the appendages, and that many of the layers seemed to be the result of physiological conditions rather than of morphological value, he passed to a comparison of the appendages.

Feathers differ from the scutae of the tarsus in that the internal surface of the mucous layer becomes exposed to the air; they arise as hemispherical knobs, not as folds; they may grow upon the scutae; and the final structures are totally distinct. The supposed scale-like nature of penguin-feathers has, moreover, been proved to be a fallacy.

Scutae are separated from the scales of reptiles, with which they have have been assumed *a priori* to be homologous, in that they arise as folds; they have not the complex structure of scales, they shade into the papillae of the plantar surface of the toes, and they may bear feathers. Finally, any point of resemblance between feathers and scales also exists between the two, and the folds on the tail of the rat or opos-

sum; in fact, there is very little difference between the first and the last; yet one would hesitate to call the folds on the opossum's tail scales.

The claws are shown by their positions, structure, and development to be homologous with those of other vertebrates. Wattles, spurs, and the bill seem to be special formations.

Mr. Jeffries finally stated that he had been unable to find any resemblance between the papillae in the mouth and feathers; the papillae being comparable with those of other vertebrates, and the jelliform structure found in the ducks being due to a lack of development of certain epithelial cells. — (*Bost. soc. nat. hist.; meeting* Feb. 7.) [337

Motor disturbances following lesions of the internal ear. — Operative difficulties have hitherto prevented any extended series of experiments on mammalia in this connection. Vulpian has lately employed the method of injecting irritating liquids into the external auditory meatus of rabbits. A few drops of a 25 per cent solution of chloral hydrate in water, when injected, cause motor disturbances within fifteen minutes; these become more pronounced, and next day attain a maximum; the limbs are moved with uncertainty in locomotion, and the animal frequently falls; the head is twisted on the spinal column so that the cheek of the side on which the injection was made is turned upwards; there are circus movements towards the side of the operation; the animal rolls over and over around its longitudinal axis; there is nystagmus; and also the muscles of the two eyeballs cease to be co-ordinated in their action, so that one eye is turned upward and the other towards the ground. Post-mortem examination showed no lesion in the brain cavity, but destruction of the labyrinth so extensive that no statement as to any specific connection of any one part of the internal ear with the motor disturbances could be made. The phenomena are much less marked when dogs are substituted for rabbits. — (*Comptes rendus*, cxvi. 1883, 90.) H. N. M. [338

Reptiles.

The carpal bones of Dinocerata. — During a communication on the tarsus and carpus of the Dinocerata, Mr. Jacob L. Wortman referred to Prof. Marsh's statement, that the scaphoides in the proximal row of the carpus is supported below by the trapezium and trapezoides, and that it does not touch the magnum. In the figure of the anterior foot, however, which Prof. Marsh published with this description, he makes the scaphoides to articulate with the magnum, although stating directly to the contrary. The speaker had recently made a careful study of the remains of Uintatherium, belonging to Princeton college, and had found that the scaphoides does touch the magnum; thereby establishing the fact that Prof. Marsh's figure is right, although his description is wrong. The carpal bones, therefore, of the proximal and distal rows form distinct interlocking series; indicating that the Dinocerata can no longer remain as a sub-order of the Amblypoda, but must be placed in the Diplarthra of Cope, which includes the Artiodactyla and Perissodactyla, and corresponds with the Ungulata of authors. — (*Acad. nat. sc. Philad.; meeting* Feb. 20.) [339

ANTHROPOLOGY.

Aborigines of Andaman islands. — In our childhood we imbibe the opinion that African and Negro are co-extensive; but ethnology acquaints us with these two propositions, — not all Africans are Negroes, and, not all Negroes are Africans. The natives of the Andaman islands, off the west coast of Farther India, are a woolly-haired black race, like the negritos of Malacca and the Philippines. Mr. E. H. Man, who has lived among them, has been giving to the British anthropological society a series of sketches concerning them, the last of which appeared in a late number of the journal. Many precious facts respecting their language are presented. For instance, they coin native compounds for new ideas: as, *ârla*, daily, and *ik-yâ'b*, repetition, for prayer. They have a poetic dialect that subordinates to rhythm the forms of words, and even sentential structure. A very elaborate system of possessive pronominals is in use. There are, of these, three principal classes: 1, for nouns denoting human objects; 2, for names of parts of the body; 3, nouns of relationship. Again, No. 2, has seven subclasses: I. Used with names for head, brain, neck, chest, heart, etc. II. With hand and foot, and their parts. III. With shoulder, arm, breast, face, temple, etc. IV. With body, back, thigh, calf, elbow, stomach, liver, etc. V. With leg, hip, loin, bladder, etc. VI. With mouth, chin, lip, throat, etc. VII. Only with waist. Class 3 has eight subdivisions.

The word-construction is both prepositional and postpositional; so much so that the two forms interfere with each other's grammatic function.

Owing to a singular practice of adoption, it is rare to see a child above six or seven years residing with its parents. It is considered a compliment for a married man, after a visit, to ask his host for one of his children. Indeed, the *soi-disant* father, may, on a similar occasion, pass the child on farther, without referring to the real parent. To prevent improper flirtations among the lads and lassies, they paint the suspected parties, one red, the other white: of course they cannot mutually embrace without partially exchanging color. Marriage is forbidden among near relatives. Relationships are traced in both lines, and the system with reference to either sex is identical; but the record fails after three generations.

Children are named before they are born, after some friend of the parent; there being no distinction of sex in these titles. As they grow up, a male or female affix is applied. At puberty the females receive the 'flower' name, after a plant blooming in the month when that takes place. The young men receive an epithet name. Between the eleventh and the thirteenth years commences the initiatory abstinence from turtle, honey, pork, fish, and other *choses défendues;* which lasts for a period of years, and is broken at last with great ceremony and rejoicing. Mr. Man takes occasion to correct a great many marvellous stories about the unchastity and inconstancy of the Andamanese, and paints a very pretty picture of their simplicity and fidelity in matrimonial matters. The marriage-ceremony is described in charming style.

Much ceremony is practised in the burial of the dead; infants being deposited under the hearth of the hut where they died, and adults upon a 'machan,' or platform, in the jungle, or in a grave. Temporary migrations in either case follow death, in order to allow the spirit of the deceased full range around the old haunts. After a proper time the dead are exhumed, their bones cleaned and made into jewelry and mementos. The belief in spirits is evident from the ceremonies accompanying interments.

Friends, at meeting, stare at each other until the younger speaks; relatives embrace, and howl hideously. For each particular kind of meeting there is a special form of salutation, in which tears form the chief ingredient.

Fire-making is unknown; but the modes of pre-

serving the fire furnished by the active volcano of one of the islands are very ingenious. Many misstatements have been made concerning their former ignorance of fire.

The closing part of Mr. Man's paper, relating to superstitions, beliefs, and mythology, furnishes a tempting field for the prolongation of this notice; but the want of space forbids. — (*Journ. anthrop. inst. Gr. Br.*, xii. 117.) [340

The Papuans and the Polynesians. — Students of ethnology are astonished and perplexed at the occurrence of a patch of mop-headed blacks occurring in the oceanic area that extends south-easterly from New Guinea to Fiji, and various have been the attempts to classify them. Mr. A. H. Keane has elaborated a scheme of all the oceanic peoples in the ethnologic appendix to Stanford's Compendium for Australasia. To this arrangement Mr. C. Staniland Wake takes exception, in a paper read before the London anthropological institute, which called forth a sharp rejoinder from Mr. Keane. Mr. Wake's own views may be briefly stated: —

1. The Eastern Archipelago was early inhabited by a straight-haired Caucasian race, represented by the Australians. 2. To this race belonged also ancestors of the Papuans, Micronesians, Tasmanians, and Polynesians. 3. The special peculiarities of the dark races are due to foreign elements, the Negritos having influenced them all in varying degrees. 4. The lighter races show Negrito influence, but they have been intermixed with Asiatic peoples, giving rise to the Malay and the Polynesians. 5. Traces of an Arab or Semitic element appear among all, but chiefly among the Papuans and Melanesians, the former of whom may also possess a Hindoo admixture. — (*Journ. anthrop. inst.*, xii. 197.) [341

Pebbles resembling artificial objects. — Dr. Jos. Leidy called attention to a collection of large pebbles, which illustrated how closely certain natural forms may sometimes resemble works of primitive manufacture. The pebbles have the general shape of human feet, and might readily be supposed to have been used as lasts upon which the moccasins or sandals of prehistoric man were shaped. — (*Acad. nat. sc. Philad.; meeting* Feb. 5.) [342

PSYCHOLOGY.

Apparent size of magnified objects. — A paper (to appear elsewhere) was read by Prof. W. H. Brewer, in which he gave the results of several hundred estimates by as many different observers chosen from different classes of people, of a common insect as seen magnified by a microscope. These estimates were found to vary from a fraction of an inch to several feet, the actual apparent size at ten inches being a little over four inches. — (*Conn. acad. arts sc.; meeting*, Dec. 20.) [343

Experiments in binary arithmetic. — Simple addition involves several distinct but nearly simultaneous mental operations, and a capital of more than fifty propositions committed to memory. The object of the experiments by the author of the paper, Mr. Henry Farquhar, was to test the possibility of diminishing the mental strain, and consequent liability to error, by the use of numbers expressed in powers of 2, the mental work being reduced to counting similar marks and halving their sums. Columns of numbers of six or eight figures each were written with the ordinary, and with various forms of binary, notation; and comparative additions were made. To avoid confusion of columns it was found best to give different shapes to the marks denoting neighboring powers of 2; and, for brevity of expression, two or more of them were combined in one written figure. About seventy combinations were tried, with various results. With the best combination, addition required only three-fourths the time taken with ordinary figures; and this was reduced to one-half when the binary notation was taught to a person unskilled in arithmetic.

The only natural division is by bisections; hence the superior convenience of a binary scale of weights; and hence another reason for endeavoring to introduce a binary arithmetic.

In the discussion which followed, Mr. William B. Taylor said the world was losing so much by the use of the denary arithmetic, that even a single generation might find economy in substituting the octonary. The paper had especial value in that it proved the ability of binary arithmetic to compete with the established system in rapidity of computation. — (*Phil. soc. Wash.*; *meeting* Jan. 13.) [344

Varying the thermal background of reflex perception. — The background of conscious perception, physiologically speaking, is defined by W. T. Sedgwick as "that standard (usually unconsciously held) with which we compare any stimulus which awakens consciousness." We perceive difference of relative intensity between a specific stimulus and its background. The latter may vary so that a stimulus which will to-day cause consciousness or motion will not do so to-morrow. Instead of studying the reflex background by means of inhibitions, the author varies the background as a whole thermally, and observes its effect on reflexes. A reflex or headless frog may be heated so slowly, that, although the heart may beat very fast, *rigor caloris* may be caused without any motor re-action of its limbs. If the heart be tied beforehand, reflexes occur from gradual heating.

This the author thinks explained by assuming; that, in the first case, the hot blood passing inward equalizes the progressive heating throughout, or changes the thermal background; while in the second case, with no circulation, the background is fixed, and the surface temperature rises to the point of difference which causes movement. — (*Johns Hopk. univ. circ.*, Feb., 1883.) G. S. H. [345

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

Manitoba fishes. — A collection of fishes from Manitoba, the first received for twenty years, shows that the fish-fauna of that region does not differ materially from that of the lake states.

Number of visitors in 1882. — The reports of the doorkeepers, which have been regularly made since Feb. 8, 1882, show that the average daily attendance at the museum building for that year was 535 persons, and, at the Smithsonian building, 488 persons. Estimating upon this basis, the attendance for the year 1882 may be placed at 183,265 for the museum building, and 152,822 for the Smithsonian building. When the re-arrangement of the collections in the latter

building is completed, the number of persons entering the doors will undoubtedly be the same as the number entering the museum building. The average daily attendance upon the museum at present is about 1,200.

Fisheries exhibit. — A preliminary display of the fisheries exhibit to be sent to London took place in the halls of the museum on the evenings of the 26th and 27th insts. About five thousand invitations were distributed by the commissioner of fisheries for the first evening, and were universally responded to. On the second occasion the general public was admitted without reserve. The exhibit may be pronounced remarkably comprehensive in scope, and complete in detail. The mounting of the various objects has been done in a very careful and artistic manner. Packing will begin at once.

Geological survey.

Division of mining statistics and technology. — According to an act of Congress passed at the last session, the survey is charged with the duty of collecting and publishing statistics of the mineral industries of the country (other than gold and silver mining). The plan also includes technical discussions and industrial notes; the general aim being to furnish matter of a practical character, thus correlating the purely geological work of the survey. The reports are to be issued as semi-annual bulletins, in octavo, the first of the series bearing date of July 1, 1883.

The scope of this work embraces a wide range of topics, among which are coal, iron, petroleum, copper, lead, zinc, quicksilver, nickel, tin, manganese, antimony, bismuth, salt, graphite, phosphates, barytes, asbestos, borax, gypsum, sulphur, mica, felspar, and many other substances; together with lists of localities of the useful minerals, statistics of mine accidents, etc.

Although mining statistics have been for many years published as government reports in Great Britain, France, Belgium, Holland, Russia, Germany, Austria, Sweden and Norway, Victoria, New South Wales, Queensland, Nova Scotia, and other countries and colonies, the United States have been hitherto without accounts of their mineral products, excepting such as are included in the reports of mining commissioners for the precious metals, state mineralogists, state geological surveys, and in census returns and the commercial reports of the bureau of statistics. While much creditable work has been done, and valuable information imparted, in a desultory way, both have been limited by local restrictions, or have wanted continuity. The general government has never before attempted systematic effort in this direction.

Bureau of ethnology.

Explorations of the pueblos of Tusayan. — During the earlier part of the past field-season, one of the parties of the bureau, under the charge of Mr. Victor Mersdeleff, has been at work among the pueblos of the ancient province of Tusayan, making such measurements, drawings, and plans, as will enable him to prepare models of the seven Moqui towns, on a scale sufficiently large to exhibit not only the architectural details of the villages themselves, but also the essential features of the high, precipitous mesas upon which they stand.

The party first visited the towns of Té-wa, Se-chum-o-vi, and Wol-pi, — all built, in the order named, on one mesa promontory.

It is an interesting fact that the inhabitants of Té-wa, although in such close proximity to the other towns, have preserved their own customs and institutions in many respects entirely distinct from their neighbors. They manufacture a certain quality of undecorated pottery, which is not found at any other of the Moqui towns. It will be well represented in the collections from this region.

Wol-pi is remarkable for the position it occupies on the extreme point of the mesa peninsula, the neck connecting it with the main body of the mesa being not more than twelve feet wide. It is the largest of the three villages; and the small, rocky promontory on which it is built is well crowded with clusters of dwellings. In many cases, a back wall is built within a few inches of the edge of the vertical precipice; and the weathering and undermining of the rock has, in some instances, disturbed the foundations of the homes, compelling their abandonment. The trails from these villages to the plains below are very steep and rugged, in some cases descending by means of rude steps in crevices between the rocky wall of the mesa, and detached slabs of rock that have fallen from above.

The next field studied was the town of O-rai-be, which is by far the largest of the entire group, and the most isolated, maintaining very little intercourse with strangers. This pueblo is arranged with much regularity, considering the extent of ground it covers. The vast, irregular, hive-like cluster of houses usually seen in other pueblos is not found here. The buildings are arranged approximately in rows, and never exceed four stories in height. The fact that several additions to houses were being built during our short stay would seem to indicate that these people are increasing.

The three towns of the 'middle mesa' were the last group visited. Two of them — Mé-shong-i-ni-vi and Shi-pau-a-lu-vi — are quite close together; while Shong-a-pa-vi, the third, is on a spur of the same mesa, three miles to the westward. The latter is the most regularly planned of all the towns. Entrance from the roof — a conspicuous feature in the architecture of more exposed pueblos — is here found only on the first mesa, and then only occasionally, many houses being unprovided with them. The natural inaccessibility of these villages would seem to render this precaution unnecessary. It is a noteworthy fact, that, in almost every instance, the terraced side of the houses, with all the doors and windows, face eastward; the back of each row usually being a vertical wall without receding stories, and with very few openings. Even when parallel rows occur, they occupy the position stated above, instead of being built facing each other.

Incidentally to the work among these pueblos, the party visited and surveyed the ruins of a very extensive ancient pueblo, situated ten miles east of the first Moqui mesa, and known by the Navajo name of 'Talla Hogan.' From the data collected, models can be made which will be accurate as to the relative position and size of minor features; such as doors, chimneys, ladders, etc.

Upon the completion of the surveying-work, Mr. Frank H. Cushing joined the party, and a collecting expedition was organized to work among these Indians. In addition to a very full and complete collection of the modern pottery, baskets, and dance-paraphernalia, there were secured many pieces of ancient ware of rare form and decoration, and in a perfect state of preservation. The Moquis stated that some of these had been dug up on the sites of ancient pueblos; and, indeed, many of them bear evidence of recent exhumation. A few, however, seemed to be considered as heirlooms. Some of the villages appear to entertain reverence for certain ruin

sites, — so much so, that the prospect of gain cannot induce them to collect any of their ancient remains, or to reveal the location of these ruins to the white man. Other ruins they explore as thoroughly as their rude means will permit, without any compunction.

Stone implements, and stone images of animals, used as fetiches, were also collected. Many specimens of basket-ware — some of types not made by the present pueblos — were secured. The art of basket-making flourishes best among the O-rai-bes, who exchange their products for the pottery of the other villages. Most of these are made in the form of flat, circular trays, of two styles of manufacture, — one a wooden variety, very light, made by the people of O-rai-be only; the other type, coiled spirally, and much stronger and heavier, is made by both the O-rai-bes, and the inhabitants of the villages on the middle mesa.

A large number of brightly decorated wooden images — representations of gods presiding over various dances — were collected. Some of these had been deposited at a sacrificial shrine that was discovered in the vicinity of Mē-shong-i-ni-vi.

PUBLIC AND PRIVATE INSTITUTIONS.

State university of Kansas, Lawrence.

Weather report for February. — Although the lowest temperature of this month was one degree lower than any previous February minimum of our sixteen-years' record, its mean temperature was not so low as in 1874, 1875, and 1881. The mean height of the barometer exceeded every previous monthly mean. The rainfall was nearly double the average; and this is but the third month in the past year in which the rainfall has reached the average. The cloudiness and humidity were much above the average, while the wind-velocity and depth of snow were normal. Before the ice 'broke up' in the Kansas river in the middle of the month, it had reached a thickness of twenty inches.

Mean temperature, 27.92°, which is 5.64° below the average February temperature of the fifteen preceding years. The highest temperature was 67°, on the 28th; the lowest was 13° below zero, on the 4th; monthly range, 80°. The mercury fell below zero on three days. Mean temperature at 7 A.M., 21.34°; at 2 P.M., 34.44°; at 9 P.M., 27.96°.

The winter now closing, although cold, has been less severe than the winters of 1872–73, 1874–75, and 1880–81.

Rainfall, including melted snow, 2.31 inches, which is 1.05 inches above the February average. Rain or snow, or both, fell on ten days, on one of which the quantity was too small to measure. The depth of snow was 4 inches. The entire depth of snow for the winter has been 14½ inches. There was one thunder-shower, with sleet, on the 3d.

Mean cloudiness, 51.67 % of the sky, the month being 5.98 % cloudier than the average. Number of clear days (less than one-third cloudy), 12; entirely clear, 3; half-clear (from one to two thirds cloudy), 5; cloudy (more than two-thirds), 11; entirely cloudy, 7; mean cloudiness, — at 7 A.M., 55.36 %; at 2 P.M., 55.71 %; at 9 P.M., 43.93 %.

Wind, N.W. 29 times, S.W. 26 times, N.E. 24 times, S.E. twice, S. once, N. once, E. once. The entire distance travelled by the wind was 10,593 miles, which gives a mean daily velocity of 378 miles, and a mean hourly velocity of 15.76 miles. The highest velocity was 50 miles an hour, on the 24th.

Mean height of barometer, 29.340 inches; at 7 A.M., 29.340; at 2 P.M., 29.332; at 9 P.M., 29.348; maximum, 29.869, at 9 P.M., on 17th; minimum, 28.492, on 15th, at 2 P.M.; range, 1.377 inches.

Relative humidity: mean 77.9, at 7 A.M. 85.8, at 2 P.M. 64.9, at 9 P.M. 83.0; greatest, 100, on ten occasions; least, 41, on 19th.

The following table furnishes a comparison with preceding years: —

FEBRUARY.	Mean Temperature.	Maximum Temperature.	Minimum Temperature.	Inches of Rain.	Mean Cloudiness.	Mean Humidity.	Miles of Wind.	Inches of Snow.
1868	35.71	72.0	*—3.0	0.19	24.71	....	....	0.50
1869	30.63	66.0	—5.0	1.44	51.20	83.1	....	5.25
1870	35.42	69.0	—4.0	0.03	43.69	61.6	....	0.00
1871	35.30	71.5	—6.0	2.43	49.85	74.3	....	4.00
1872	30.44	62.0	—12.0	0.82	54.94	70.4	....	7.75
1873	30.26	62.0	—6.5	0.86	45.95	68.1	12,827	3.00
1874	27.06	49.0	2.0	0.95	60.94	78.2	9,195	10.00
1875	21.92	55.0	—8.0	0.80	50.48	74.7	11,865	4.00
1876	37.80	74.5	—5.0	0.36	38.16	59.0	15,236	0.25
1877	39.65	66.0	21.0	0.80	47.13	71.8	7,718	2.00
1878	40.22	66.0	15.5	2.86	54.63	78.5	7,303	2.50
1879	34.06	74.0	5.0	0.41	39.04	64.7	10,097	4.50
1880	37.58	64.0	8.0	0.73	24.94	61.5	11,861	0.00
1881	25.78	61.5	—5.5	4.60	54.17	79.8	12,142	22.00
1882	41.65	73.0	12.0	1.66	45.49	69.7	11,907	2.00
1883	27.92	67.0	—13.0	2.31	51.67	77.9	10,593	4.00
Mean of 16 Februaries .	33.21	66.0	—0.29	1.33	46.06	71.7	10,901	4.49

* The minus-sign denotes temperature below zero.

Peter Redpath museum of McGill university, Montreal.

Logan memorial collection. — This includes: 1°. Series of large slabs of Protichnites and Climactichnites, collected by Mr. Richardson at Perth, Ont. 2°. Collection of graptolites and trilobites from the Quebec group, collected by Mr. Richardson at Lévis and Matane. 3°. Cast of skeleton of Megatherium Cuvieri, cast of skull of Mastodon, footprints of dinosaurs, and other large casts of fossils, purchased of

Messrs. Ward & Howell. 4°. Collection of animals especially illustrative of geology. 5°. Large slabs of Laurentian limestone, with Eozoon canadense.

The whole of these are labelled 'Logan memorial collection,' and a large commemorative inscription is attached to the support of the skeleton of Megatherium.

Carpenter collection of Mollusca. — This magnificent collection now appears with all the advantages of ample space and light; the four table cases occupied in the old museum having been increased to eight, with upright cases for the larger specimens and alcoholic preparations. In the process of removal, the arrangement has been carried out in the manner originally contemplated by Dr. Carpenter; and all the tablets have been carefully gone over by Mr. Curry, and cleaned, and loose specimens re-cemented; while additional species have been mounted or removed from the drawers to the glass cases, so as to render the exhibited collection more complete. The collection is now in excellent condition, and thoroughly available for scientific use, and, it is hoped, is so protected that it will remain free from dust or other injury for an indefinite period.

Collections of Principal Dawson. — These include: 1°. Specimens of Eozoon canadense and illustrative forms, as Stromatopora, etc. 2°. Cambrian fossils from New Brunswick, etc. 3°. Upper Silurian fossils from Nova Scotia, Gaspé, etc. 4°. Devonian plants and fishes from Gaspé, New Brunswick, Maine, etc. 5°. Carboniferous reptiles, fishes, insects, millipedes, crustaceans, shells, etc., mostly from Nova Scotia. 6°. Carboniferous plants, principally from Nova Scotia and New Brunswick. 7°. Post-pliocene fossils of Canada, with additional specimens from the United States and Europe. 8°. Recent shells dredged in the Gulf and River St. Lawrence, illustrating the modern fauna and the post-pliocene fossils. Also collections of Canadian crustaceans, hydroids, bryozoons, sponges, etc. 9°. Miscellaneous collections of Canadian and foreign fossils, rocks, etc.

The whole of these specimens are disposed in their places in the general collection, with the exception of the fossil plants and recent shells, which are in separate cases. They include the greater part of the types of the species described or catalogued by Dr. Dawson, and many of the specimens are unique.

Illinois state laboratory of natural history, Normal.

Distribution of school collections. — This institution, which seems to be unique in some of its characters, makes regular provision for the supply of small synoptical collections in zoölogy to the public high schools of the state. A distribution recently closed includes 10,170 specimens of pinned insects, representing 529 species, belonging to all the orders except Diptera; 2,350 alcoholic specimens of Illinois fishes, belonging to 71 species; and 890 echinoderms, coelenterates, and other aquatic invertebrates in alcohol. Similar collections were issued two years ago, the present distribution completing the supply of all the public high schools of Illinois in which zoölogy is taught as a regular study of the course. It is interesting to note that the number of high schools in which this subject is systematically studied is between seventy and eighty.

NOTES AND NEWS.

— The treasurer of the Balfour memorial fund acknowledges the following subscriptions: Thomas J. Clarke, New York, $2; Henry Sewall, Univ. Michigan $15,; C. V. Riley, Agric. Dept., Washington, $5; C. E. Hanaman, New York, $25; Dental classes 1883 and 1884, Univ. Michigan, $6; O. C. Marsh, New Haven, $25; Alex. Agassiz, Cambridge, $50; Henry Holt, New York, $10; previously acknowledged, $247.

— Peter Merian died last month at Basel, his native town, at the age of eighty-seven, having been born in 1795. After studying at Paris from 1817 to 1819 under Cuvier, Brongniart, and Geoffroy St. Hilaire, Merian returned to Basel, and began at once the study of the geology of the Swiss Jura, and the formation of one of the best collections of fossils now in existence. Attached to the university of his native place as professor of physics and chemistry, then as rector, and finally as professor of geology, he devoted nearly all his time to the development and progress of the museum of natural history, which is mainly his work. There he first classified the large and important family of Ammonites, separating them into groups according to their external forms. During a visit from Leopold von Buch (the great Prussian paleontologist and geologist, engaged then on his monograph of the Ammonitidae), this *savant* was not a little impressed to find that Merian had anticipated his classification in all the main points. From that time a most intimate friendship existed between the two men until the death of von Buch in 1853. By its central position in western Europe, Basel was a place of necessary detention for all travellers, especially before the construction of railways; and few travelling geologists have passed through it without visiting the museum of Peter Merian. Rarely absent, very hospitable, having inherited a large estate, he gladly received at his table in town or at his country-place all who called on him. Scientific men certainly are not always rich, nor always most particular in their dress or manners; yet all, rich or poor, well or shabbily clothed, were received with equal cordiality. His wife, however, somehow came to the conclusion that all scientific men were a ragged or extraordinary set, even the rich; such, for instance, as Leopold von Buch, always so odd, the absent-minded Charles Lyell, the original Ami Boué, or the stiff and formal Elie de Beaumont. One day, in 1846, a young geologist presented himself at the museum, taking notes of all the fossils. Merian, struck by the application and good air of the foreigner, asked him to dine with him; "because," said he, "Madame Merian is always reproaching me for bringing home the most indecorous and rough-looking set of fellows; and I shall be glad to show her one man at least on whom she will look without contempt."

Merian never published much; but all his memoirs are very suggestive and important. The first was on the Jurassic formation in the canton Basel. It appeared as long ago as 1821, and was completed in 1826 by a new survey of the cantons of Basel and

Solothurn. Of the last, Jules Thurmann, the author of the classification of the remarkable orography of the Jura mountains, says, "La coupe de M. Merian fut pour moi un vif trait de lumière, qui me donna sur le champ la clef du dédale où mon imagination avait souvent cherché un fil conducteur." The Black Forest was also carefully studied by Merian. Finally, in company with his friend, the late Escher von der Linth, he solved that vexed problem, the geological age of the celebrated formation of St. Cassian in the Alps. Merian was a great friend of Agassiz, who published his fossils in his *Poissons fossiles, Echinodermes de la Suisse* and *Monographie des myes;* and he was among the first to accept the theory of glaciers and a 'glacial epoch.'

— Those who have profited by Troschel's valuable work, *Das gebiss der schnecken*, will be glad to know that it is not to be left incomplete by the author's death. The publishers, at the suggestion of Professor von Martens, have made arrangements with Herr Schako of Berlin to carry the work on at least to the end of the Rhiphidoglossa, and perhaps through the Docoglossa. Time will determine whether a still farther extension of its scope will be practicable. Professor Troschel left no unpublished manuscript, but a certain number of unfigured preparations; while the whole series previously figured are in good condition, mounted on microscopic slides, and form a large and valuable collection, now at Berlin.

— The American academy of arts and sciences held an adjourned stated meeting on Wednesday, Feb. 14. Louis Pasteur was elected as foreign honorary member in place of the late Charles R. Darwin, and Matthew Arnold as foreign honorary member in place of the late Arthur P. Stanley. The following papers were presented: Quantitative researches in photography, by William H. Pickering; Photography as a means of determining the light and color of the stars, by Edward C. Pickering and William H. Pickering; On the historical hydrography of the west coast of North America, by Justin Winsor.

— The Philosophical society of Washington, at its meeting Feb. 24, listened to papers by Prof. J. W. Chickering, on the Thermal belts of North Carolina; by Mr. G. K. Gilbert, on The response of terrestrial climate to secular variations in solar radiation; and by Capt. C. E. Dutton, on The geology of the Hawaiian islands.

— The National academy of sciences will hold its annual meeting in Washington, April 17 and succeeding days, and, on the last day of the session, witness the unveiling of the statue of Professor Henry, by Story, upon the Smithsonian grounds.

— At a meeting of the section of chemistry and physics of the Ohio mechanics' institute, March 1, papers were presented on the Discovery of a method for iridium-plating, by Prof. William L. Dudley; Studies in chemical dynamics (abstract from Ostwald); the Phosphides of platinum, and a Chemical theory of odors, by Prof. F. W. Clarke. The latter provoked considerable discussion.

At a meeting of the section of mechanics and engineering, Feb. 27, Mr. J. G. Danks read a paper on the History of the mechanical puddling-furnace.

— Those of our readers who happen to live at a little distance from the heart of a city must frequently have noticed a lack of accord between the readings of their own standard thermometers and the published observations of the signal-service observer of their locality. The reason of the discord is plain; viz., the perturbing action of the heat which the city emits: and, however gratifying it may be to the outsider to find himself superior to the government observers, it is very little to the credit of the weather bureau that this particular source of error was not long since recognized and avoided. From the scientific point of view, it is simply lamentable that many an old suburban fogy, operating, perhaps, with a shilling thermometer, is to-day getting better observations of minimum temperatures — observations which, poor and incomplete as they are, are really more accurate, and which would in the future be more useful if they could only be preserved and published — than the U. S. signal-service observers can obtain within the city, in spite of their training and prestige, and of their perfected instruments and appliances.

The remarks of Professor Whitney on this subject, as applied to observations made at London, are so pertinent and convincing, and they bear so directly upon our own city of Boston, that we quote them here as a just expression of scientific opinion. In his 'Climatic changes of later geological times' (p. 228), while criticising certain conclusions of Glaisher, Professor Whitney says, —

"It is a well-known fact, that cities are considerably warmer than the more thinly inhabited country, otherwise under similar climatic conditions. Statistics prove this to be true; and there could be no doubt that such would be the effect of an immense aggregation of population within a limited space, even if there were no statistics bearing on this question. Many millions of tons of coal are burned in and about London during every year; and the whole mass of brick of which the city is built is heated during the entire winter, and more or less in the summer, many degrees above the natural temperature. There can be no question that conditions such as are here indicated vitiate all observations made in or near large cities, with a view to the determination of any possible secular variation of the temperature." It is to be regretted that "most of the longer records of temperature come from observatories situated either within or very near to cities where the conditions have not remained the same, but have been rapidly changing, and in such a way, we have good reason to believe, as to produce a decided effect on the temperature."

— Dr. G. Steinmann, privat docent at the Deutschland university of Strassburg, writes from the Straits of Magellan, under date of Dec. 23, that he has explored the whole Brunswick peninsula (Tierra del Fuego), and that at Mount Tarn, Port Famine, he

has collected the Crioceras simplex, as Darwin did, besides other cretaceous fossils, several of them new to science. He found the southern extremity of the Cordilleras to be formed wholly of cretaceous strata, mainly of neocomian age. The strata are very complicated, and recalled to his mind the neocomian of the French Alps, near Escragnolles (Var.).

— An entertainment fund has recently been endowed in the Philadelphia college of physicians by Dr. S. Weir Mitchell. The income is to be used, under the direction of a standing committee, to defray the expenses of occasional receptions, at which refreshments suited to the dignified character of the society are to be provided. It is proposed to issue invitations not only to members of the college and other physicians, but also to laymen who may be identified with the intellectual welfare of the city.

— We regret to learn that Mr. Alexander Murray, director of the Geological survey of Newfoundland, owing to illness and old age, is obliged to relinquish field-work, and to retire altogether, his medical adviser having recommended him to go to a milder climate. Mr. Murray is one of the pioneers of American geology, having commenced as the first and only assistant on the Geological survey of Canada when it was organized in 1842, and then as director of the survey in Newfoundland since 1864. His assistant, Mr. J. P. Howley, will continue the survey of the island.

— There has been an unusual awakening in scientific circles in Cincinnati this winter; a polytechnic school has been organized; a state forestry association formed, with its headquarters in Cincinnati; and courses of popular lectures on chemistry, zoölogy, botany, and history, have been given at the Afternoon school in popular science and history.

— The students of the Institute of technology in Boston propose to place in the entrance-hall of the building a bronze tablet in memory of the late Professor William B. Rogers. The committee in charge of the matter recommend that it be peculiarly a student memorial, and that the sum required for its erection be raised by contributions from the students exclusively.

— Dr. F. G. Hahn gives a favorable review of A. Penck's *Schwankungen des meeresspiegels* (*Ausland*, 1883, 91). The review calls attention to previous suggestions by Bruchhausen, Stokes, and others, of unevenness of the sea-surface caused by continental attraction, and thinks that the departure of the ocean's surface from the theoretic spheroid may be as much as 1,000 or even 1,500 metres.

— According to official returns, there were in Australasia in 1880, 75,237,917 sheep, 8,104,786 cattle, 1,206,100 horses, 1,026,898 pigs. Forty-seven per cent of the sheep were owned in New South Wales.

— Dr. Ritzema, in the 'Versleg van den landbouw in Nederland,' highly compliments the work of the entomological division of the Department of agriculture.

— The ninth and tenth parts of the *Geologische tabellen und durchschnitte* of the St. Gotthard tunnel have appeared.

— At the meeting of the Biological society of Washington, March 2, Prof. O. T. Mason gave a paper on the Human fauna of the District of Columbia, which was an exceedingly interesting review of the constitution of the population of the district, the nationalities represented, the percentage of crime and disease in each nationality, etc., derived from a study of the records of the census, the health-office, and the police-service. Dr. M. G. Ellzey read a paper on Hybrid sterility.

— At the meeting of the Boston society of natural history, March 7, Prof. G. Fred. Wright of Oberlin read a paper on the Glacial phenomena of Ohio, and Prof. A. Hyatt proposed for the whole range of the sciences which directly treat of the earth and its products, whether organic or inorganic, the term 'Physiognosy.'

— No work upon anthropology of recent date has invaded a more unworked field, or has cultivated its area with more thoroughness, than Col. Mallery's 'Sign language.' The most flattering notices have appeared in many of the foreign journals; and a translation into the German language has been made by Agnes Brauer, bearing the title: Forschungen und anregungen über die zeichensprache der Indianer Nord-Amerikas. Von Garrick Mallery. Uebersetzt von Agnes Brauer. Mit Anmerkungen von Wilhelm Keil. Sonderdruck aus den Mittheilungen des vereins für erdkunde zu Halle, a.-S., 1882 (Halle a-S., 1882).

— At the meeting, yesterday, of the Society of arts of the Massachusetts institute of technology, Mr. H. A. Hill described the Cummer steam-engine, and Mr. F. C. Childs exhibited and described the new and sensitive electro-thermostat of the Automatic fire-alarm association.

— The 47th Congress included in its appropriation bills several items for the U. S. geological survey. They amount in total to $341,140, and are available during the fiscal year beginning July 1, 1883. This is $82,700 greater than the appropriation for the current fiscal year.

— Dr. H. O. Marcy has again brought to public notice the researches of Ercolani on the placenta, by publishing in the *Annals of anatomy and surgery* for November, 1882, a well written abstract of a part of the results of the Italian embryologist. Under the designation of "A unity of anatomical and physiological modality in all vertebrates," he also renews the familiar comparison between the absorption of food by the blood-vessels from the yolk and from the placenta.

— With the current number the *Quarterly journal of microscopical science* assumes a new dress. An enlarged page and better paper permit an improve-

ment in the typography, while the plates are also more capacious. The whole result is a higher excellence in all the material qualities of the journal, which is well matched by the worth and importance of the articles. Professor Lankester has been most successful in his management of this publication; for, when he began, its value was so much inferior to that it now has, that the progress is remarkable. What was the not very important organ of amateurs has become a leading journal.

— The death is announced, Dec. 7, of Mr. G. W. Belfrage, an assiduous collector of insects in Bosque County, Texas.

— A new natural history society has been organized at Trenton, N.J., with Prof. Ellis A. Apgar, state superintendent of public instruction, as president, and Dr. C. C. Abbott as secretary.

— In the year 1800 there was founded at Paris a society entitled 'La société des observateurs de l'homme.' While no one would expect to find such an organization invested with all the modern improvements, a perusal of their first instructions to observers will both gratify and agreeably astonish the student of to-day. The document appears in full in the January number of the *Revue d'anthropologie*, filling twenty-two closely printed pages.

— A plate reproducing the appearance of a part of the relief-map of France, by E. Guillemin, is given in *La Nature*, Jan. 6, 1883.

— The scientific results of the fourth polar voyage (1881) of the 'William Barents' are reviewed in *Ausland*, 1883, 61–68.

— Mr. Charles Henry Hart is the author of a memoir on Lewis H. Morgan of Rochester, N.Y., read before the Numismatic and antiquarian society of Philadelphia, May 4, 1882, and published by the society. The works of Mr. Morgan are briefly reviewed; but a bibliography, which would be of great service to students of anthropology, is wanting.

— In article 189 of our 'Summary,' the reading should be: "as has been done by M. Marey in his 'photographic gun,'" and not 'photographic sun.'

RECENT BOOKS AND PAMPHLETS.

Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.

Buckley, A. B. Botanical tables for the use of students. *New ed.* London, *Stanford*, 1883. 12°.

Cameron, J. Gaelic names of plants, Scottish and Irish. London, *Blackwood*, 1883. 8°.

Dutton, Clarence E. Tertiary history of the Grand Cañon district, with atlas. Wash., *Government*, 1882 (U. S. geol. surv. — monogr. ii.). Text 264 p., 42 pl. 4°; atlas 23 pl. f°.

Echegaray, J. Teorías modernas de la física, unidad de las fuerzas materiales. *2a ser.* Madrid, *Gaspar*, 1883. 238 p. 8°.

Electricidad (La.) — Revista general de sus progresos científicos é industriales. Dir. Rojas. Año i. núm. 1, Barcelona. Enero, 1883. 12 p. 4°. (Bimonthly.)

Garrido Villlazán, A. — Topografía militar. Madrid, *Guirnalda*, 1882. 135 p., 4 pl. 8°.

Greer, Henry. A dictionary of electricity or the electrician's hand-book of reference. N.Y., *Allison*, 1883. 192 p. 12°.

Guillaume, Dr. L'eau du Seyon et la fièvre typhoïde à Neuchâtel. Rapport présenté à la direction de l'intérieur au nom de la commission d'état de santé. Neuchâtel, *imp. Borel*, 1882. 60 p., 1 pl. 8°.

Heitzmann, C. Microscopical morphology of the animal body in health and disease. With 380 original engravings. N.Y., *Vail*, 1883. 19 + 849 p. 8°.

Hoffer, R. Practical treatise of caoutchouc and gutta percha. London, *Low*, 1883. 12°.

Hopley, Catherine C. Snakes: curiosities and wonders of serpent life. London, *Griffith*, 1883. 618 p. 8°.

Hunziker, O. Die übergangszeit des volksschulwesens der Schweiz. Zürich, *Schulthess*, 1883. 8°.

—— Vorgeschichte und anfänge des volksschulwesens in der Schweiz. Zürich, *Schulthess*, 1883. 8°.

Lawrence, W. T. Principles of agriculture. Stage 1-2; 2-3. Edinburgh, *Chambers*, 1883.

Marcet, W. The principal southern and Swiss health resorts; their climate and medical aspects. London, *Churchill*, 1883. 408 p. 8°.

Marshall, G. F. L., and **Nicéville**, L. de. — Butterflies of India, Burma and Ceylon; all the known species of rhopalocerous Lepidoptera, and allied species of neighbouring countries. Vol. i., part 1. London, *Quaritch*, 1883. 8°.

Martin, H. Newell, and **Moale**, William A. Handbook of vertebrate dissection. Part. ii. How to dissect a bird. N.Y., *Macmillan*, 1883. pp. 89-174. 4 pl. 12°.

McAdams, W. Antiquities of Cahokia, or Monks' Mound in Madison County, Illinois. Edwardsville, Ill., 1883. 13 p., plates. 4°.

Mendive, José. Elementos de cosmología. Valladolid, *Vinda*, 1882. 150 p. 4°.

Modet y Riglos, Andrés. Ensayo sobre el establecimiento y la conservación del catastro en España. Precedido de un prólogo de A. Blanco. Madrid, *Murillo*, 1882. 16+403 p., 3 pl. 4°.

Nasmyth, J. Engineer; an autobiography; ed. by Samuel Smiles; with a portrait by George Reid and numerous illustrations. London, *Murray*, 1883. 468 p. 8°.

Newcomb, Simon. Popular astronomy. *2d ed. revised.* With 116 engravings and 5 maps of the stars. London, *Macmillan*, 1883. 596 p. 8°.

Pinner, Adolph. An introduction to the study of organic chemistry. Transl. and revised from the fifth German edition by Peter T. Austen. N.Y., *Wiley*, 1883. 19+403 p. 16°.

Pocock, R. The Gravesend historian, naturalist, antiquarian, botanist and printer; by George M. Arnold. London, *Low*, 1883. 276 p. 8°.

Report of the Smoke abatement committee, 1882; with reports of the jurors of the exhibition at South Kensington, and reports of the testing engineer, to which are added the official reports on the Manchester exhibition, 76 plates of illustrations, and 34 tables of results of tests of heating and cooking grates and stoves, steam boilers, appliances, fuels, etc. London, *Smith & E.*, 1883. 4°.

Ridsdale, B. Scenes and adventures in great Namaqualand. London, *Woolmer*, 1883. 294 p. 8°.

Ridsdale, C. H. Chemical percentage tables and laboratory calculation. London, *Lockwood*, 1883. 80 p. 8°.

Spencer, Herbert. Education, intellectual, moral, and physical. *New ed.* London, *Williams & Norgate*, 1883. 168 p. 12°.

—— Principios de sociología, trad. por Eduardo Cazorla. 2 tom. Madrid, *Calleja*, 1883. 16+488 p. 4°.

Swindell, J. G., and **Burnell**, G. R. Rudimentary treatise on wells and well-sinking. *Rev. ed.*; with a new appendix on the qualities of water. London, *Lockwood*, 1883. 106 p. 12°.

Townsend, F. — Flora of Hampshire, including the Isle of Wight; or a List of the flowering plants and ferns found in the county of Southampton, with localities of the less common species. Illustrated with 2 plates and a map. London, *Reeve*, 1883. 544 p. 8°.

Triboulet, Maurice de. Cours de minéralogie générale et appliquée, professé à l'académie de Neuchâtel (1877-82). Neuchâtel, *Berthoud*, 1883. 264 p., 16 pl. 8°.

Westwood, T. and **Satchell**, T. — Bibliotheca piscatoria: a Catalogue of books on angling, the fisheries and fish culture; with bibliographical notes and an appendix of citations touching on angling and fishing from old authors. London, *Satchell*, 1883. 410 p. 8°.

Williams, F. S. — Our iron roads; their history, construction and administration. With numerous illustrations. *2d ed., rev.* London, *Bemrose*, 1883. 530 p. 8°.

PUBLISHER'S DEPARTMENT.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

FRIDAY, MARCH 16, 1883.

INTERNATIONAL STANDARD TIME.

AT the last session of Congress, an act was passed, requesting the President of the United States "to extend to the governments of all nations in diplomatic relations with our own, an invitation to appoint delegates to meet delegates from the United States in the city of Washington, at such time as he may see fit to designate, for the purpose of fixing upon a meridian proper to be employed as a common zero of longitude and standard of time-reckoning throughout the globe." The delegates from the United States, three in number, are to be appointed by the President.

The Secretary of State, under direction of the President, has recently sent a circular to the government representatives abroad, requesting them to bring the matter before the foreign governments. The circular states that "The President, while convinced of the good to flow eventually from the adoption of a common time-unit, applicable throughout the globe, thinks, however, that the effort now to be made should be to reach, by consultation, a conclusion as to the advisability of assembling an international congress, with the object of finally adopting a common meridian. He therefore abstains from extending an invitation for a meeting at an assigned day, until he has ascertained the views of the leading governments of the world as to whether such international conference is deemed desirable." The object of the circular is thus to ascertain from each government whether it would accept an invitation "to participate in an international conference at a date to be designated in the near future."

In our opinion, the action of the President is wise. It is better to interest foreign governments in the plan, by asking their opinion of the feasibility of holding a conference, than to request them at the outset to send delegates. The chances are thus increased, that, when the conference does meet, its action will meet the approval of the co-operating governments. There is, however, danger that our representatives abroad will not be sufficiently zealous in pressing this matter upon the attention of foreign governments. It would be unfortunate if the subject should fail because of the lukewarmness of government officials. We hope that scientific men everywhere will make an effort to further this movement by every means possible.

IT is announced that Professor Nordenskiöld will take part in an arctic expedition during the coming summer. The Danes, who have for several years quietly pursued arctic explorations in Greenland with praiseworthy energy and notable success, will attempt investigations on the south-east coast of Greenland this summer. A recently received letter states that the skin-boats, or *umiaks*, are now being constructed for the purpose.

The neglect, up to date of writing, of our naval authorities to, in any adequate way, recognize the services to their comrades, and to the reputation of the navy, of seamen Ninderman and Noros of the 'Jeannette' expedition, is exciting unfavorable comment among those interested in arctic matters. Heroism and fidelity into the very jaws of death are surely worthy of encouragement, even without the passport of a commission.

THE debates and newspaper comments on an effort recently made in the Massachusetts legislature to prevent the unnecessary and unseasonable ringing of factory-bells in towns and villages, go to show how far we are yet from a practical application of Emerson's dictum, that "the Ought, that Duty, is one thing with Science, with Beauty, and with Joy." We should be glad, in this connection, to call the attention of legislatures to the one conspicuous commandment which modern science has set forth; viz., "You may do what you please in this world, provided you do not infringe upon the rights, the peace of body and mind, and the prosperity, of your neighbor." The justice of this decree is plain to observation; and the applicability of it to the clangor of inopportune bell-ringing is assuredly not

No. 6.—1883.

far to seek. We would submit that many easy ways suggest themselves of awakening a sluggard without need of molesting the sleep of his just, and presumably virtuous, neighbor. There be, in manifold variety, clock-alarums, clepsydras, sand-glasses, and galvanic appliances, which are fully competent to privately admonish a slumberer, without any public scandal; not to speak of the old English method, by which an active lad gained a weekly wage by ringing the house-bells of his heavier-sleeping comrades. In one word, there is a right and a wrong in this matter of the bell-ringing, as science has made plain. It is not in the least a question to be determined to-day or to-morrow by the votes of interested parties; for the correct and the final solution of it was written long ago, in the name of eternal justice and the immutable fitness of things.

ON AN ALLEGED EXCEPTION TO THE SECOND LAW OF THERMODYNAMICS.

ACCORDING to the received doctrine of radiation, heat is transmitted with the same intensity in all directions and at all points within any space which is void of ponderable matter and entirely surrounded by stationary bodies of the same temperature. We may apply this principle to the arrangement recently proposed by Prof. H. T. Eddy [1] for transferring heat from a colder body A to a warmer B without expenditure of work.

In its simplest form the arrangement consists of parallel screens, which are placed between the bodies A and B, and have the form of very thin disks with certain apertures, and the property of totally reflecting heat. These disks, or screens, are supposed to be fixed on a common axis, and to revolve with a constant velocity. For the purposes of theoretical discussion, we may allow this velocity to be kept up without expenditure of work, since we may suppose the experiment to be made *in vacuo*. If the dimensions and velocity of the apparatus are such that the screens receive a considerable change of position during the time in which radiant heat traverses the distances between them, the apertures in the screens may be so placed that radiations can pass from A to B, but not from B to A. It is inferred that it is possible, by such means, to make heat pass from a colder to a warmer body without compensation.

In order to judge of the validity of this inference, let us suppose thermal equilibrium to subsist initially in the system, and inquire whether the motion of the screens will have any tendency to disturb that equilibrium. We suppose, then, that the screens, the bodies A and B, and the walls enclosing the space in which the experiment is made, have all the same temperature, and that the spaces between and around the screens and the bodies A and B are filled with the radiations which belong to that temperature, according to the principle cited above. Under such circumstances, it is evident that the presence of the screens, whether at rest or in motion, will not have any influence upon the intensity of the radiations passing through the spaces between and around them; since the heat reflected by a screen in any direction is the exact equivalent of that which would proceed in the same direction (without reflection) if the screen were not there. So, also, the heat passing through any aperture in a screen is the exact equivalent of that which would be reflected in the same direction if there were no aperture. The quantities of radiant heat which fall upon the bodies A and B are therefore entirely unchanged by the presence and the motion of the screens, and their temperature cannot be affected.

We may conclude *a fortiori* that B will not grow warmer if A is colder than B, and none of the other bodies present are warmer than B.

Since the body A, for example, when the screens are in motion, does not receive radiations from every body to which it sends them, it is not without interest to inquire from what bodies it will receive its share of heat. This problem may be solved most readily by supposing the screens to move in the opposite direction, with the same velocity as before. One may easily convince himself that every body which receives radiant heat from A when the apparatus moves backward, will impart heat to A when the apparatus moves forward, and to exactly the same amount, if its temperature is the same as that of A. J. W. GIBBS.

[1] Journ. Frankl. Inst., March, 1883.

PHOTOGRAPHIC FOCUSING.

CONSIDERABLE discussion has arisen of late as to the propriety of focusing with a large stop, and then using a much smaller one with which to make the exposure. Most of those who have written upon the subject have assumed that it was merely a question of spherical aberration. It seems to the writer, how-

ever, that spherical aberration has little, if any thing, to do with it, as, in lenses constructed on the modern curves, this defect has been practically reduced to zero. If now we take a perfectly corrected, wide-angled lens, and focus it on the centre of the plate, we shall find that the objects near the edges are somewhat indistinct, and by no possible combination of curves can this difficulty be wholly remedied; it is, however, reduced proportionally to the size of the stop employed. It has been shown, by Prof. E. C. Pickering and Dr. C. H. Williams (*Proc. Amer. acad.* 1875, 300), that, with a single lens, a series of concentric circles would be focused on a spherical plate whose radius of curvature was 0.7 the focus of the lens. On the other hand, the diameters of these circles could only be accurately focused on a spherical plate whose radius of curvature was 0.3 of this focus. As far as the writer is aware, no name has ever been given to this optical defect; but for convenience' sake it might be called the *field aberration.*

If the central object on the plate is of the most interest, we shall focus on it, and then push in the plate as far as possible without injuring the central definition, to obtain the best possible result at the edges. Supposing now we insert a smaller stop, the definition over the whole plate will be improved certainly; but, that at the centre having been sufficiently sharp before, we can now afford to push in the plate a little farther still, and obtain better definition at the edges, without perceptibly injuring that at the centre. Therefore, on theoretical considerations merely, we should always focus with the stop we are going to use. But, on the other hand, for lenses of less than 45° angle, or when the illumination is very faint, the practical advantage of a bright image for focusing would more than compensate for the advantages of using the other stop. In practice, for accurate work, the best way would be to determine once for all the difference of focus required by each stop, and then focus with the largest, and apply the proper correction, depending on the stop used.

W. H. PICKERING.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

II.

THE Serrin regulator, arranged for alternating currents, has been adopted as the standard lamp. No other apparatus has given better results. Especially with alternating currents, its working is excellent, because the armature of the electro-magnet detaches itself very easily; and besides, as the consumption of both carbons is uniform, the arc remains absolutely fixed.

The machines for generating the current have been of late years the subject of attentive study, which has been unfortunately confined to three types, — the Alliance, Gramme, and de Meritens. The luminous intensities of each of these machines have been measured under carefully arranged conditions. Photometric measurements in such cases are rather delicate. To make them, since the intensity varies in the vertical direction with different heights, a movable mirror is used, which is placed at different heights in the same vertical plane, and which, in each position, throws the rays on the photometer; and thus the average intensities could be obtained. But, as the intensity of the electric light constantly varies, it was necessary to make the observations at one-minute intervals for each position of the mirror. It is not necessary here to go into the details of construction of the different machines; the table below gives the results obtained.

Machines.	Number of revolutions per minute.	Horse-power. Total.	Horse-power. Less power used in transmission.	Luminous intensity. Total. Carcels.	Luminous intensity. Per horse-power. Carcels.
Alliance	450	5.18	4.62	275	59.5
Gramme, No. 1 .	550	12.04	11.48	1,010	88.5
" No. 2 .	600	6.01	5.45	493	90.0
" No. 3 .	680	7.06	4.20	342	81.4
De Meritens . .	790	8.06	7.50	536	84.8

It will be seen, that the Alliance machine gives a far less intensity per horse-power than the two others, which are approximately equal. The de Meritens has certain characteristics of stability and solidity which the Gramme machine does not possess; it was, besides, preferred to use alternating currents. For these reasons it has been adopted, and will be installed in all the new lighthouses.

The figures giving the intensity in the preceding table refer to the naked light. When this is placed in a fixed-light apparatus, these intensities become, in round numbers, 12,000 carcels with the Alliance, and 20,000 carcels with the Gramme No. 2. The flashes increase

[1] Continued from No. 5.

the intensity still more. In a scintillating light with red and white flashes there is an intensity

FIG. 2.

FIG. 3.

of 60,000 carcels with the Alliance, and 110,-000 carcels with the Gramme machine; with a scintillating light with groups of white flashes, 90,000 carcels for the former, and 150,000 carcels with the latter. The intensities with the de Meritens machine are about the same as with the Gramme; and 125,000 carcels may be taken as the average intensity when the electric light is used.

Some details will now be given of the installations actually existing, and of those in process of construction; specially describing the lights of la Hève, the first in date to be electrically lighted, and the Planier light, whose installation has just been completed.

The lights of la Hève, situated on the cape of this name and on the top of the cliff, are, from this fact, very elevated: so the towers themselves are not of great height. Both

FIG. 4.

towers are square, and are placed about sixty metres apart; between them being the long building containing the steam-power, generators, and quarters for the keepers.

There are four Alliance machines, — two for each light. The two on the left supply the left-hand tower; and the two on the right, the tower on the right hand. The conductors leading the current from the generator are first thick copper rods connected with the commutator, Fig. 2. The rod A communicates with the two similar poles of the two machines, the rods B and B′ being connected to the opposite poles. Ordinarily one machine supplies each light. Thus the current arrives by A,

and, without traversing the commutator, goes by the cable to the regulator (or lamp); thence it returns by the second wire of the same cable to N, follows the vertical conductor to P, and returns to the machine by the rod B. If it is desired to use the machine corresponding to

FIG. 5.

the rod B′, the central handle is turned, thus bringing the plate D in contact with P′ instead of P, retaining always the contact at N. In this case the current arrives, as before, at A, goes to the regulator, returns again, but passes this time from N to P′, and thence to the machine by B′.

In foul weather, or whenever it is necessary to increase the luminous intensity, both machines are coupled in quantity. The commutator is then turned until the plates E and E′ are in contact, — the one with P′ and N′, the other with P and N; the return current flowing simultaneously by B and B′.

The tower of each light is surmounted by a square structure, at one of the angles of which is the optical apparatus. This is clearly shown in Fig. 3. A kind of glass drum closes the open angle of this structure, which is in two stories, in each of which is a distinct optical apparatus. The intention of this arrangement is to allow one optical apparatus to be instantly replaced by the other, in order to avoid total extinction in case of accident. In each story, there are two regulators, which can be substituted for each other by means of the crossed rails shown in Fig. 4. The cable with three conductors leading from the commutator, previously described, arrives at the lower story. One of the conductors (A) is connected to the metal platform carrying the rails, also metallic; the conductor B connects with the sliding rod of the long bolt M T. When this bolt is lowered, it connects the conductor B with a wire going from the bottom staple of the bolt to a spring contact under the lamp. The latter re-

FIG. 6.

ceives the current, partly by the rails, partly by the contact underneath. The wire B communicates with a smaller bolt sliding at the same time with M T, and whose lower staple is connected to the wire coming from the staple of the larger

bolt; so that, when the current passes by B′, it always traverses the lamp, and, when the two machines are at work together, the two currents are united by the connection between the two staples. The upper staples are connected in the same way to the apparatus in the second story; and, when the bolts are raised, the upper lamp is lighted.

The regulators can thus be changed in two ways, — either by drawing the lamp at work back on the rails, and quickly pushing the other one in its place; or by manipulating the commutator bolt, which shifts the luminous

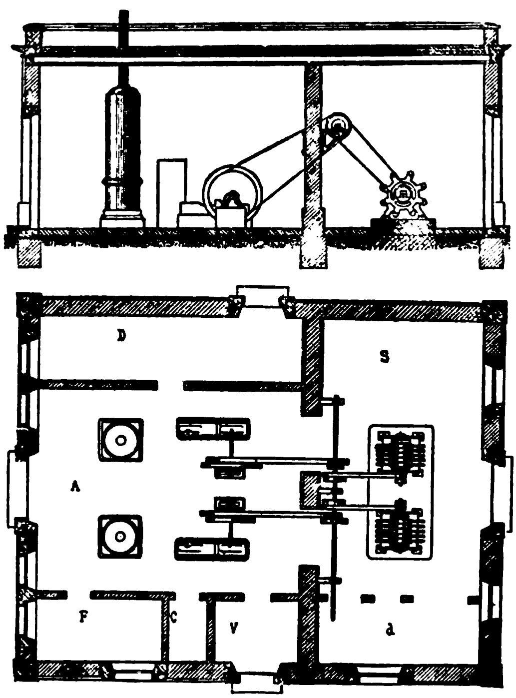


FIG. 7.

A. — Engine and boiler house. S. — Electric generator room. F. — Forge and heavy repair-shop. d. — Shop for light repairs. D. — Coal dépôt, with water-tank underneath. c. — Water-tank. V. — Vestibule.

arc from one story to the other. Since the establishment of the lights at la Hève, the latter means have been found superfluous, and will no longer be employed.

The light of Planier, which has just been finished, is about eight nautical miles from the port of Marseilles, upon a rock. It is a tower sixty metres high, and eighteen metres in diameter at the base, which rests on the rock itself.

Fig. 5 gives the details of the summit of the tower, and Fig. 6 those of the optical apparatus. In the latter figure are shown the fixed-light apparatus, and, movable around it, the drum, with vertical lenses. The mechanism for driving the latter is given in considerable detail.

In this apparatus the changing of the regulators is effected by means of a system of two pairs of rails; but they are not placed at an acute angle, as at la Hève. One enters direct

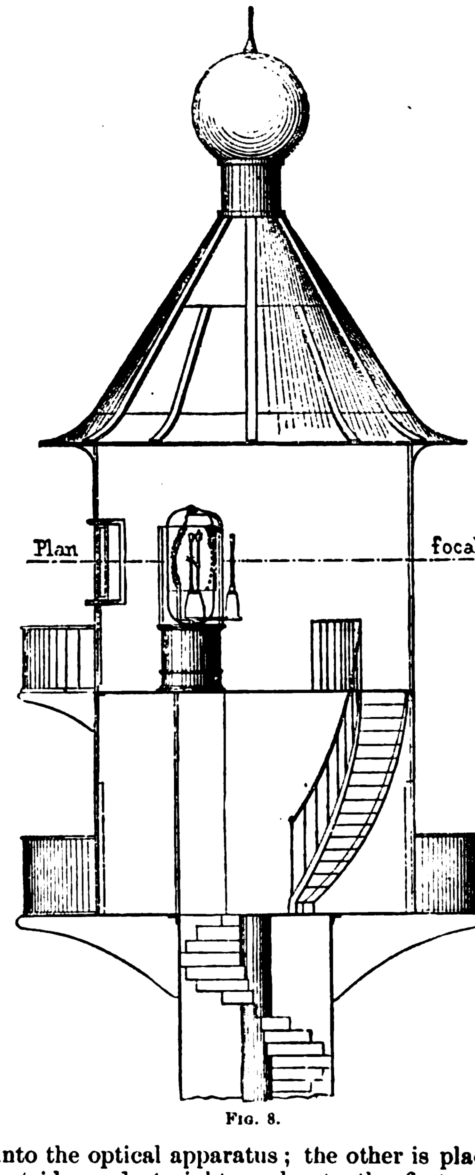


FIG. 8.

into the optical apparatus; the other is placed outside, and at right angles to the first. At their junction is a turn-table; and, with this arrangement, the manoeuvre of changing the lamps takes no longer than with oblique rails.

The de Meritens machines, which feed the regulator, are placed in a special building.

The plan and elevation of this building, which will serve as a type for those installed in most of the lighthouses, is shown in Fig. 7.

The Planier is a full horizon light. Its characteristic is that of three white flashes separated by a red flash. Its range, like that of all the new lights in the Mediterranean, is twenty-seven nautical miles for fourteen-fifteenths of the year.

We have mentioned that the transformation of the Palmyre light is also in progress. This, unlike the Planier, will throw a beam in one direction only; and the arrangement of the lantern is therefore slightly different. It is shown in Fig. 8. The general disposition resembles, up to a certain point, that of la Hève. The optical apparatus for the new fixed lights will have a diameter of 0.6 met., instead of 0.3, as was formerly employed. With the revolving cylinder of vertical lenses, this diameter will reach 0.7 met.

CRITICISM OF PROFESSOR HUBRECHT'S HYPOTHESIS OF DEVELOPMENT BY PRIMOGENITURE.

EVOLUTIONISTS have hitherto been puzzled to find a full and satisfactory explanation of the persistency of certain types, such as the familiar Lingula and others, through long periods of the earth's past. Prof. A. A. W. Hubrecht of Utrecht has offered, in his inaugural address, an hypothesis which he thinks adequate to solve this problem. The address is published in full in Nature, nos. 690–691. We may pass over the first part, which contains familiar matter only, and which, therefore, we venture to advise scientific readers to skip. The presentation of the author's own views begins near the bottom of the first column on p. 302. The habit of needless diffuseness in writing is a very grave encumbrance to scientific literature, and ought always to encounter the critic's emphatic condemnation.

The theory which Professor Hubrecht has advanced appears to us not only untenable, but unscientific; we think it might be characterized as pure speculation of that reckless quality which of late years has crept into zoölogy, considerably to the discredit of the science. To justify this condemnation, we will first state the author's hypothesis, and afterward the objections to it.

The hypothesis may be summarized as follows: 1. In many animals the period of reproduction is a prolonged one; so that there are young born of young parents, others of old parents, and, of course, of parents of intermediate age. A distinction therefore exists between first-born and last-born posterity. 2. Similarly, these first-born will likewise have first- and last-born; so, also, will the last-born; consequently there will be one set of generations of the first-born, and another set of the last-born. 3. In the first series the generations will follow rapidly, in the second series slowly, upon one another; hence, from a given pair, there will be in time numerous descendants; "a small number of these being descendants in a direct line of the first-born of every successive generation, another small number being the descendants in a direct line of the last-born of every successive generation." Consequently, of the contemporaneous generations, the individuals of the first set would have numerous ancestors; those of the second set, not nearly so many. 4. The age of the parent affects the character of the progeny. Of this, Hubrecht is able to bring forward only one example, — apparently the only one known to him; namely, that Stone found in the McCloud River that the eggs of young salmon are smaller than those of old salmon. 5. "I must now call your attention to the second cardinal point. . . . Heredity has, indeed, invested them [the progeny] with peculiarities, part of which show themselves in their organization; another part remaining latent, and only attaining development in following generations. Such a latent potential energy towards eventual modification of the individual or his progeny must needs find more occasions to unfold itself in the first-born, *simply because these are possessed of a larger number of ancestors*" (the italics are ours). 6. Asexual reproduction is accompanied by less variation than sexual.

From these premises, the deduction: that the first-born of sexual generations are the principal variants, and *ergo* the principal source of new species; and the last-born, *per contra*, the representatives of stability.

In rejoinder to this plausible but specious argument, our contention is, *first*, that we cannot assume that there are really any series of first- and last-born; *second*, that, granting the distinction between them, it cannot be assumed that one is more variable than the other; *third*, granting both these premises, the facts of zoölogy cannot be made to show that the permanence of types is derived from the last-born, nor that the evolution of new species depends on primogeniture to any considerable extent.

First, Any succession of first-born would depend upon both parents being first-born; and the probability of both parents so being for any considerable number of generations is so infinitely small that it might be called zero. Let us take a species which pairs (a bird, for example), and where the male fertilizes only one female. Let us assume that in a given locality there are ten of each sex, and of various ages, and that there is an equal chance of any two pairing; then the probability of the first-born male pairing with the first-born female would be 1 in 100. The chances of the next set pairing in the same manner would be also 1 in 100, if we further assume, what is the usual case, that the number of individuals remains constant. The chances of both pairs being first-born would be 100×100, or 10,000. In nine generations the chance of their being all first-born would become 1 in 1,000,000,000,000,000,000 (one million million million). Now, for birds which become mature in one year, these are the chances for nine years. Birds are known first from the Jurassic, which we will call for convenience 1,000,000 years ago; so that it might prove laborious to write out the chances for that period, the chance being the last term of a geometrical progression of which one million is the number of terms, and one hundred the ratio. Yet we have taken a case exaggeratedly in favor of Hubrecht's view. It were possible to adduce many arguments to show that the habits of animals often render the existence of a series of first-born improbable; but the previous calculation sufficiently disposes of Hubrecht's fundamental assumption. And, moreover, every such calculation would lead to essentially the same result, whatever the figures chosen to start with might be, because the chance is the last term of a geometrical progression. If Pro-

fessor Hubrecht finds mathematics unconvincing, we would beg him to consult genealogical records, by which he could ascertain the carefully registered contradiction of his assumption that there is a series of the first-born, or even an approximation to it.

Second, We cannot accept the assertion, that a large number of ancestors increases the tendency to variability, because the direct influence of the progenitors upon the production of variations very rapidly diminishes as the number of generations increases. And, on the other hand, it is well known that long-inherited characteristics are the most constant. The more ancient a feature is, the greater its fixity: hence we might as well assume the opposite of Hubrecht's assertion; viz., that the greater the number of ancestors, the more fixed the qualities of the young. Here it may be noticed, that although it is very probable that the parents' age causes modifications in the young, yet Hubrecht mentions only one fact to support the assertion, and that fact is the only one brought forward to support any portion of his hypotheses. We certainly have no sufficient reason for agreeing with the assumption that first-born would be more variable than last-born.

Third, If we admit the two previous premises, we should still have to show that they have given us the determination of the real causes. If evolution by primogeniture were a real cause, then the most variable animals, or those classes where there are most species, would, in consequence of inherited habit, produce young while themselves young, and the stable types would have acquired the characteristics of reproducing very late. Such, however, is not the case. Insects, the most variable of types, reproduce, for the most part, at the end of their lives; while the permanent type, Lingula, reproduces while young. Further objections might be added; but sufficient has been said to explain. and, it is believed. to justify, the condemnation of the hypotheses involved in the author's generalization.

Professor Hubrecht, by his able morphological researches on various subjects, notably on the anatomy of nemertines, has earned a well-deserved esteem: and it is a matter of regret to have to criticise any writing of his severely; but the tendency to draw a maximum of conclusion from a minimum of fact is one to which we feel impelled to object most strenuously. Hubrecht (p. 279) speaks almost sneeringly of what he is pleased to call the school of scientific zoölogists,[1] or those who have sought to elevate zoölogy above mere systematic work. The cause of his *animus* we do not know, but feel that he is hardly just, and not likely to wish to be called an *unscientific* zoölogist himself. Of his hypothesis of development by primogeniture, our opinion has been expressed.

CHARLES S. MINOT.

NOTES ON THE GEOLOGY OF JAPAN.

WE are permitted, by the courtesy of M. Jules Marcou of Cambridge, to make use of the following extract from a letter addressed to him from Tokio by Dr. C. Gottsche, professor of geology in the Tokio *daigaku*, or imperial university.

Since you published, seven years ago, the *Explication d'une carte géologique de la terre*, much has been changed in Japan. Lyman's flying surveys in Yesso and Japan expired in 1879. A new geological survey has been established, under the superintendence of Dr. E. Naumann; geology has been taught for more than six years, both in the university and at the engineering college of Tokio; and travellers are allowed to cross the interior in every direction. A mass of information has been procured in this way; and I suppose you will find valuable materials in the notices, and in the little sketch-map my friend and countryman, Dr. Naumann, is just preparing for you. Nevertheless, I take the liberty to furnish you with some additional remarks on facts or specimens which I have recently examined, and which might be overlooked by him.

The upper Devonian system is indicated by half a dozen specimens of Spirifer disjunctus de Verneuil, which I met in several old Japanese collections, and which partly originate from the provinces Tosa (on Shikoku) and Ise (on the main island). This fossil has not yet been met with *in situ*.

The carboniferous system is only represented by marine limestones, which are exposed in seventeen localities along the eastern coast of Japan, from 39° 10′ N. L. to 31° 20′ N. L. The fauna is very scanty; but everywhere the limestones are characterized by the common occurrence of Fusulina and Schwagerina, which in many cases are accompanied by Endothyra, Textilaria, and Trochammina. Among other fossils, I mention only Bellerophon (?) hiulcus Sow., Favosites, and Poteriocrinus.

The limestones correspond, in my judgment, to the whole carboniferous system, the upper productive series included. My reasons are: 1°. The different paleontological character of the lower carboniferous mountain-limestone of Lo-ping in China (cf. Kayser, *Zeitschr. deutsch. geol. gesellsch.*, 1881, 351); 2°. The common occurrence of the genus Schwagerina, which I think is confined to the uppermost carboniferous and lower dyassic systems of Nebraska, Russia, and Austrian Alps; 3°. The researches of V. von Möller, who states that the marine carboniferous limestones of Russia also represent the entire system. From the second point, it might seem that our Japanese deposits correspond only to the uppermost series, which in China is really productive.

The dark triassic shales, with Monotis salinaria, var. Richemondiana Zittel, which Dr. Naumann discovered near Sendai (*Jahrb. k.-k. reichsanst.*, 1881, 519), now extend from 40° N. L. (Niageba, province of Ugo) to 33° N. L. (Kinkaisan, province of Higo). This will be the more interesting to you as special care is devoted in your Explication to the Monotis strata. Very similar dark shales from Okatzumura and Minatomura, district of Ojikagori, province of Rikuzen (about 38° 30′ N. L., 141° 20′ E. long., Greenw.), are lower liassic. I recognized within them Arietites bisulcatus Brug., Arietites of rotiformis Sow., and Lytoceras sp. of the group of L. fimbriatum. The two Arietites are characteristic for the Ammonites Bucklandi-zone of Oppel.

The middle Jurassic is only represented by plant-bearing shales. Dr. Geyler of Frankfurt described already sixteen species from the Tetorigawa valley, in the province of Kaga (*Palaeontogr.*, xxiv. 221, 5 pl.), mostly identical with Jurassic species from Amuria, eastern Siberia, and Spitzberg. In the mean while the number of localities and fossils has somewhat increased. The said strata have been met with again at Nozirimura, province of Echizen; Ogamigo, district of Onogori, province of Hida; Midzutani, near Yuasa, province of Kishiu; and Tannomura, province of Awa, on Shikoku. The leading fossil is everywhere Podozamites lanceolatus

[1] Scientific zoölogy (*wissenschaftliche zoologie*) has had, since the establishment of Siebold and Kölliker's *Zeitschrift für wissenschaftliche zoologie*, a special significance to professional naturalists.

Lindl. sp., and P. Reinii Geyl. The fresh-water or brackish character of these deposits is proved by the occurrence of true and undoubted Cyrena sp. and Estheria.

The cretaceous fossils of Yesso are carefully examined by Naumann (*Mitth. deutsch. ostasiat. gesellsch.*, heft 21), and partly (thirteen species) identified with Indian types, partly with shells described by Schmidt, from Sachalin. His result is, that the Ammonite-beds of Yesso are upper-cretaceous, and correspond especially to the Ootatoor-group of India.

During the last vacation, I got, from Shikoku, sandstones which are also upper cretaceous. They are quite filled with a Trigonia of the scabra-group, probably T. aliformis Park. Two other Trigoniae, which I cannot determine with the literature at hand, fragments of Natica and Hamites, accompany it. The said sandstones have been met with at Oruno, district of Itanagori, province of Awa; Tannomura, district of Katsuragori, province of Awa; Yassudamura, district of Akigori, province of Tosa,—on the island of Shikoku.

The tertiary strata are rather thick. Those which have been studied by Dr. Brauns (*Mem. Tokio univ.*, no. 4, 1881) and A. Nathorst (*Svensk. akad. handl.*, 1882) are pliocene, most of the shells and plants described being identical with living ones. Miocene, or older strata, are not yet recognized with certainty.

Glacial phenomena have not left any traces in Japan.[1] I conclude here with the remark that the list of your *Explication* contains some volcanoes (nos. 8 and 9, p. 114; nos. 4 and 10, p. 115) which I cannot make out. More complete are the lists of Naumann (Yokohama, 1878) and Milne (*Trans. seismol. soc. Japan*, iv. 1882): but even these are not complete; for a recent revision I made gave forty-eight volcanoes which are active now, or have been active within historical time, or are still in the solfatara state. Besides that, I know about forty cones which are probably prior to human record, and date back as far as the pliocene series, which is very often tufaceous or filled with pumice-fragments.

[1] The writer ignores the discovery of Prof. J. Milne of the engineering school of Tokio, at the large mountain of Gwassan, northern part of Nipon, where are large bowlders and *roches moutonnées*,—the product of glacial action.—J. M.

PERFECT INTERFERENCE OF SOUND BY TELEPHONE.

SUPPOSE we have two telephones having the poles of their magnets similarly placed, and so connected with a circuit that a current will traverse their coils in the same direction. It is evident that any electric current passing will cause a simultaneous movement in the same direction in the diaphragms of both telephones. Now, if we conceive the current reversed in one of the telephones, the motions will have opposite signs. It follows, then, that the currents due to the vibration of the diaphragm of a third telephone in the circuit will produce in the two telephones vibrations of *opposite phases;* the sounds produced, therefore, will differ by a half-wave length. The same current which in one telephone produces a condensation will in the other produce a rarefaction.

The experiment, as successfully tried in the physical laboratory of Dartmouth college by Professor Emerson and myself, was arranged as follows: the mouths of two similar telephones were placed before the extremities of a Y-shaped tube, and the sound from both telephones conducted to the ear by rubber tubing. A reversing-switch was placed in the circuit, by means of which the direction of the current in one of the telephones could be changed; in this way could be produced at will coincidence or interference of sound. Each branch of the Y-tube was of rubber, so that either arm could be closed by pinching. Organ-pipes of various lengths were sounded near a telephone in a neighboring building. It was found, that, when arranged for interference, the pinching of either of the branch-pipes produced a very decided increase in the intensity of the sound; when reversed, an equally decided decrease. The inequality in the intensity of the sounds due to the two telephones was found to be the chief difficulty in producing complete interference; but by partly closing one branch, so as to weaken the stronger sound, the effect was much improved. In several trials the interference was complete, no sound whatever being audible. The rapid reversal by the switch gave a sharp contrast between the strengthening and the weakening effect.

This method of demonstrating the phenomenon of interference has obviously the advantage of applicability to sounds of any pitch. With singing, the interference was very satisfactory, especially with the lower notes; in conversation, however, the sound is not so much weakened, but the quality is perceptibly changed. The vowels seemed to suffer much more than the consonants. C. S. COOK.

RAILWAY-ACCIDENTS IN 1882.

THE statistics of railroad operation in this country are far too incomplete and unreliable to admit of drawing any very general conclusions. Certain facts, however, appear with sufficient distinctness to show some very grave defects in the system under which our roads are worked. The *Railroad gazette* publishes monthly and annually a list of accidents to trains while in motion. This, however, does not include over twelve per cent of the whole number of casualties. Again, accidents not resulting in loss of life or in serious damage to property are rarely recorded; though in many cases the blame is not less great, and the lesson conveyed not less important. The total number of train-accidents for the past ten years is returned as below; the second horizontal column showing the actual number, and the third column the number per thousand miles of road in operation:—

1873	1874	1875	1876	1877	1878	1879	1880	1881	1882
1,283	980	1,201	982	891	740	910	1,078	1,458	1,365
18.3	13.6	16.2	12.8	11.3	9.0	10.6	11.6	13.9	12.4

If we regard the second line alone, the figures would seem to be sufficiently discouraging, as there is a steady increase in the number of accidents from 1878 to 1881. We must, however, take into account the growth of the railroad-system. This is done in the third line; and here, again, while we find a somewhat less rate of increase, the fact still remains, that our roads are not growing safer as they expand in extent.

If we examine in detail the causes of accidents, we shall see that they are less dependent upon the total length of roads in operation, than upon the density of the traffic; in accordance with the law, that failures of track and bridges are approximately in proportion to the length of road, while the number of collisions is in proportion to the square of the number of trains.

Thus for the past ten years the number of collisions was as shown in the second line below, the number of derailments as in the third, and the number of broken bridges as in the fourth: —

1873	1874	1875	1876	1877	1878	1879	1880	1881	1882
392	260	278	279	268	220	310	437	536	581
815	655	840	655	581	481	557	597	857	742
19	33	26	20	21	21	17	16	44	38

While the length of railroads increased from 70,000 miles in 1873, to 110,000 miles in 1882, the whole number of accidents decreased steadily, from 1,283 in 1873, to 740 in 1878, and then increased to 1,365 in 1882; while the number of collisions ranged from 392 in 1873, to 220 in 1878, and then steadily increased to 581 in 1882. Moreover, this increase in collisions is shown very plainly to be due to the crowding of the tracks, as the butting collisions range from 102 in 1873, to 70 in 1878, and from that number to 160 in 1882; while the rear collisions run from 187 in 1873, to 142 in 1878, and from that number to 388 in 1882. Comparing the accidents month by month, we find two periods when disasters are most numerous; viz., the first quarter of the year, and the three months August, September, and October. The accidents during the first quarter are very largely due to the extreme cold of that season, — the total disasters from broken rails in the ten years above having averaged six times as many during the first quarter as in July, August, and September. Indeed, we can always detect the unusually cold winters by the number of broken rails. The disasters of August, September, and October are supposed to be due to the crowded state of the roads during the excursion-season, when a large number of irregular trains are run.

It is hard, from the imperfect records at our command, to draw such definite conclusions as would enable us to improve the condition of affairs upon our railroads; but the statistics recorded by the Gazette are of great value as far as they go, and will eventually furnish the data we need for increasing the safety of railway-travel. GEORGE L. VOSE.

LETTERS TO THE EDITOR.

A caterpillar-eating hen-hawk.

IN July, 1882, my nephew Malcolm Storer, being at Moosehead lake, had the curiosity to examine the stomach of a hawk which he had shot there, and was surprised to find that it contained a large number of caterpillars in all stages of decomposition through digestion. Though the examination was made soon after the bird was shot, none of the caterpillars were found alive; but ten or twelve of them were perfect, and fifteen or twenty could still be distinguished as caterpillars in the mass of more completely digested matter. It was evident, moreover, that the stomach contained no other kind of food. The caterpillars were of green color, with yellowish rings or blotches, and were as thick and almost as long as a man's little finger. The wings of the bird, having been brought to Cambridge, were found to be those of the broad-winged hawk (Buteo pennsylvanicus). In view of what is known of the food of hawks, it is not at all strange that they should regale themselves upon caterpillars when opportunity offers. The marsh-hawk (Circus hudsonius), for example, is said to be 'an indiscriminate feeder upon fish, snakes, and even worms;' and many other hawks are known to feed upon snakes occasionally, as well as upon lizards, in regions where they are to be had. The fact that both large hawks and small devour many insects, such as crickets and grasshoppers, has often been noticed.

F. H. STORER.

An Indian burial-mound.

At my request Mr. Frank La Flesche, an educated Omaha, made inquiries of the older men of his tribe about the burial of the famous Omaha chief Big Elk, who died about 1825. He writes me as follows: "In compliance with your request, I made inquiries about the mound made by the Omahas, in which Big Elk was buried; and was told that it was about as high as the shoulders of a tall man standing up, and that he was buried with great ceremonies. His favorite horse was strangled to death by his grave, and most of his horses and household goods were given to the poor. The place where he is buried is known by the Omahas as 'Big Elk's grave,' but by the whites as 'Black Bird hills,' as Black Bird was buried in the same place. It is said that Black Bird was buried with very little ceremony, as he died when the Omahas were being very much troubled with the small-pox; and he was *not* buried riding a live horse, as stated by some. A grandson of his is still living, and is about one hundred years old; and he thinks his grandfather died before he was born."

As we have very few reliable records of the erection of burial-mounds by Indians since the settlement of the country by the whites, the statements quoted above are of considerable importance; but these facts do not prove that all mounds are recent, or that all were made by the immediate ancestors of the Indian tribes which still erect mounds over their noted dead; any more than, for the same reason, they prove that the Omahas and other recent mound-building tribes are of the same stock with the ancient Greeks. The custom of raising a mound of earth or of stones over a grave is world-wide, and must not be taken for more than it is worth in archeology. There are so many kinds of mounds in this country, that it shows a limited experience in their investigation when a writer here and there asserts that they are all the work of the present Indians, or their immediate ancestors; and an equal disregard of known facts, when another as confidently asserts that they were all made by a people unlike and superior to the Indian race, and of great antiquity. Each earthwork, mound, and burial-place should be investigated and studied by itself. Side by side we may find earthworks entirely different in their character, and to be assigned to very diverse ages; so we may find burial-mounds of the same character near together, one of which may be so recent as to contain glass beads and other things obtained by the Indians from the whites, while the other may be of great antiquity. Their proximity will not in itself prove that they were made by the same people. Much careful and systematic work has yet to be done before the question so often asked, Who made the mounds? can be satisfactorily answered. By a proper study of the mounds and earthworks of North America, facts will at last be accumulated by which an approximate determination of their chronology and relation to existing peoples will be made possible. In this work the Peabody museum has been engaged for several years, and during the past season most important results have been secured. F. W. PUTNAM.

Cambridge, Mass., Feb. 19.

House-flies in the Philippines.

I remember, years ago, seeing a dried specimen of the house-fly sent to Boston in a letter as a great rarity there, — the only one the sender had seen in a year's residence in Manila. As this is one of the constant accompaniments of man, and a sure sign of his presence or vicinity, I was at a loss to account for its absence. It is not even found in the sugar-yards in any great numbers. I now see why it should be so rare; viz., because it could not of itself pass over the six hundred miles of the windy China sea; and the few which might be transported on vessels, if they got ashore from their distant anchorage, would be prevented from multiplying by their numerous enemies, — bats, spiders, birds, lizards, and other reptiles. Some days I would not see one, and rarely more than two, around the table. Were they common, with the other insect-pests, life would be almost unendurable in these islands. S. KNEELAND.

Solar corona.

Various reasons have been assigned for the very conflicting representations of the corona made by observers who have simultaneously sketched it. It seems to me that the principal cause of the very puzzling differences observed lies in the fact that the light of the corona falls so near the limit of visibility at the violet end of the spectrum as to excite the retina in different observers unequally.

I would have each observer tested for color-blindness in the part of the spectrum between G and H; and no doubt as great differences would be found in the sensitiveness of different eyes near the upper limits of visibility as is known to exist in different ears in perceiving sounds near the upper limit of audibility. Only those sketches of the corona could be properly compared with each other which were made by observers to whom the relative intensity of the various parts of the spectrum appeared approximately the same. H. T. EDDY.

Badly crystallized wrought iron.

An iron contractor told me, the other day, that he was called as an expert in a case where the wrought-iron strap of the walking-beam of a steamboat broke, and injured some one. The broken strap (about four by eight inches in section, I think) was shown, and the interior found to be very badly crystallized, — the worst case, my friend said, he ever saw. The exterior was of fair, ordinary texture. Afterwards, a part of the strap was cut off, sawn lengthwise into bars, and tested for tensile strength. All portions were rather weak, the highest resistance being but 36,000 pounds; but the inner sections, where the iron was worst crystallized, were the strongest of all.

Does any one know more about this case or any similar one? T. M. CLARK.

178 Devonshire Street, Boston, March 2.

WHITNEY'S CLIMATIC CHANGES.[1]

II.

IN the first part of this article the contents of the volume were described: the author's principal conclusions will now be discussed.

THE CAUSE OF THE GLACIAL EPOCH.

Professor Whitney's fundamental postulate, that the general temperature of the atmosphere is due to heat from the sun, is beyond controversy. His hypothesis that the intensity of solar radiation is gradually lessening, by reason of the dissipation of solar energy, and that the paleontologic record in arctic and temperate regions is in close sympathy with this lessening, will be admitted by most students. But when he asserts that the degradation of terrestrial climate has been continuous and uninterrupted, the glacial epoch notwithstanding, assent will not so readily be yielded. The idea that the glacial epoch was characterized by exceptional cold is all but universally entertained, and is so plausible on its face that it can be displaced only by cogent reasoning.

He advances two lines of argument, — first, that the phenomena of the glacial epoch were produced entirely by local causes, such as the elevation of mountains and the submergence of plains; second, that they belonged in the natural order of things to a warmer stage of the earth's climate, and have disappeared by reason of the secular degradation of climate. These two explanations are not clearly recognized as distinct, but are appealed to indiscriminately in the course of a somewhat desultory discussion; the one being more commonly called upon to account for the appearance of glaciers, and the other for their disappearance. If temporary local changes are competent to produce local glaciation, they would seem to be equally competent to terminate it; and a secular cause need not be appealed to. If, on the other hand, the glaciation of quaternary time has been actually abated by a secular change of temperature, it would seem logical to refer its inauguration also to a secular change.

The first line of argument is developed chiefly in a discussion of the distribution of glaciers, modern and ancient, with reference to local conditions. This is full of profitable suggestion; and it is hard to see how any one who has weighed the considerations therein adduced can entertain the hypothesis of a polar ice-cap. It appears beyond question, that the only work accomplished by the introduction of any conditions of a general nature favorable to glaciation would be the enlargement of existing glaciers, and the institution of limited ice-sheets in favorable localities. This, however, is a question of *a priori* possibilities: it is quite another matter to determine whether local conditions can be made to account for the ancient magnitude of glaciers. Whitney tells us that they can; but the only ancient ice-sheet he seriously undertakes to ex-

[1] Continued from No. 5.

plain in that way is the Scandinavian. So far as local conditions are concerned, he practically leaves the phenomena of England, Spain, Switzerland, India, New Zealand, and the Atlantic and Pacific coasts of North America, without a plausible suggestion. His analysis of the subject is, moreover, conspicuously incomplete in that it omits all but the most casual mention of ocean-currents. These great distributers of climate are in continual conflict with the elements dependent on latitude; and any remodelling of coast-lines or sea-bottoms which facilitates or impedes their circulation must influence the local distribution and local magnitude of glacial ice. While, therefore, his presentation of the subject is interesting and valuable, it is unsatisfactory. It suggests a line of inquiry of great promise, but it falls far short of a solution of the problem.

The idea that a general elevation of atmospheric temperature is more favorable to glaciation than a general lowering, is one which arises from an exaggerated appreciation of the importance of precipitation as a condition of glacier-formation. The existence of a glacier shows that the local precipitation in the form of snow exceeds the local ability of the processes of evaporation and melting to dissipate that snow in the course of the year: it shows an excess of solid precipitation over dissipation. All will admit, that, if the local temperature be lowered without a concomitant change in other conditions, the ice will increase; and *vice versa*. All will admit, too, that, if the local precipitation be increased without modification of the other conditions, the ice will be augmented; and *vice versa*. That is to say, the amount of the ice depends on local temperature and local precipitation. If the general temperature of the atmosphere be elevated by a change in solar radiation, the local effect is twofold: on one hand the local temperature is raised, and on the other the local precipitation is increased. The first change tends to diminish the volume of ice; the second, to increase it. Whitney's proposition is, that the latter tendency outweighs the former, and the glacier grows: the majority of investigators assume that the change of local temperature is the more important, and that the glacier shrinks. Considering the importance of this question to his discussion, and the all but universal prejudice against his view, it is surprising that he suffered the matter to rest with a mere declaration of opinion, without attempting a quantitative comparison. Let us endeavor to supply his omission.

There is no comprehensive knowledge of the climate of any point where glacial ice now actually accumulates; but we fortunately have an excellent meteorologic record of a station high in the Alps, where the conditions are presumably on the verge of glacier-formation, and where the climate cannot be far different from that of the surrounding ice-fields. Moreover, the observations at St. Bernard have been so thoroughly discussed by Plantamour, Wolf, and others, that the material is in the most available shape. Having for data a mathematically deduced annual curve of temperature, and an annual curve of precipitation, each based on the record for a long series of years, it is not difficult to introduce the hypothesis of a variation in general temperature, and obtain an approximate quantitative indication of the effect of this variation on glaciation. The mean temperature at St. Bernard is —1.76° (C.). Let us first assume that through a variation in solar radiation this temperature is raised 3°, and again that it is raised 6°; then that it is lowered 3°, and again 6°; and let us inquire what effect these variations will have upon the snowfall. Evidently there are two ways in which the snowfall is affected by a general rise of temperature: first, the fraction of the year during which precipitation takes the solid form is diminished, so that the snow forms a smaller percentage of the total precipitation; second, the change in temperature being general and not local, the power of the atmosphere to receive and transport moisture is increased, and the local precipitation is therefore increased. If we note the day in the spring when the curve of the annual oscillation of temperature passes upward through the freezing-point, and again the day in the fall when it passes the same point in descending, we have the limits of the portion of the year during which all the precipitation is theoretically fluid. (We are, of course, speaking of the ideal average year: in any individual year there is a time of transition, with more or less alternation of rain and snow.) Let us call this period 'summer,' and the remainder of the year, when precipitation takes the form of snow, 'winter.' Assuming that the form and amplitude of the temperature curve remain unchanged, while the mean temperature is varied as by hypothesis, we can readily ascertain the lengths of 'winter' and 'summer' for each of the assumed cases. These have been computed, and will be found in the subjoined table, lines IV. and XII. We next ascertain, by the aid of the precipitation curve, the amount of precipitation during each of these periods (V).

Computation of the relations of snowfall to melting and evaporation at St. Bernard, Switzerland.

I.	ASSUMED GENERAL RISE OF TEMPERATURE, IN CENTIGRADE DEGR.	−6	−3	0	+3	+6
II.	'Winter' begins	Aug. 17.6	Sept. 20.2	Oct. 11.1	Oct. 30.9	Nov. 23.8
III.	'Winter' ends	July 12.3	June 3.9	May 11.1	Apr. 19.9	Mar. 27.4
IV.	Length of 'winter' in days	327.7	255.7	211.0	170.0	123 6
V.	Precipitation during this period at the present time, in metres	1.1576	.9260	.7491	.5658	.3982
VI.	Mean temperature of 'winter'	−8.68	−7.74	−6.06	−4.1[illegible]	−2.10
VII.	Corresponding mean temperature over Atlantic ocean, near France	+5.2	+7.9	+10.0	+12.0	+14.5
VIII.	Tension of saturation for temperatures VII. (millim.)	6.625	7.964	9.165	10.457	12.298
IX.	Tension of saturation for temperatures VI. (millim.)	2.322	2.512	2.876	3.351	3.925
X.	Ratios of precipitation (VIII. − IX.)	4.303	5.452	6.289	7.106	8.373
XI.	Relative snowfall (V. × X. × .2122)	1.057	1.071	1.000	.853	.708
XII.	Length of 'summer' in days	37.3	109.3	154.0	195.0	241.4
XIII.	Mean temperature of 'summer'	+0.26	+2.22	+4.13	+5.93	+7 48
XIV.	Relative melting-power (XII. × XIII. × .001572)	.015	.381	1.000	1.818	2.839
XV.	Mean annual temperature	−7.76	−4.76	−1.76	+1.24	+4.24
XVI.	Corresponding tension of saturation, in mm. of barometric pressure	2.506	3.191	4.028	5.025	6.200
XVII.	Comparative rate of evaporation (XVI. ÷ 4.028)	.622	.792	1.000	1.247	1.539
XVIII.	Comparative rate of dissipation ($\frac{1}{3}$ XIV. + $\frac{2}{3}$ XVII.)	.420	.655	1.000	1.437	1.974
XIX.	Ratio of snowfall to snow dissipation (XI ÷ XVIII.)	2.518	1.635	1.000	.593	.359

The air-currents which cross the Alps, and from which the precipitation at St. Bernard is derived, acquire their moisture chiefly from the Atlantic ocean. The temperature over the Atlantic being higher than on the Alps, the air is there able to receive a larger portion of moisture than it can retain in the Alps; and in a general way the precipitation on the Alps may be said to be due to this cause. It is true that the air-currents traversing the Atlantic do not become perfectly saturated, and that on the way to the Alps they sometimes increase their aqueous contents by absorption from the Mediterranean or from the land, and sometimes diminish it by precipitation; but the only measure of Alpine precipitation available for the present purpose is obtained by deducting the co-efficient of saturation corresponding to the temperature on the Alps from the co-efficient of saturation corresponding to the temperature over the Atlantic. By ascertaining this difference for the existing temperatures, and again for the temperatures assumed in the hypothetic cases, we are able to make a comparison between the actual rate of precipitation and that which would obtain if the general temperature of the atmosphere were raised or lowered. The annual procession of temperature over the Atlantic ocean is not accurately known; but the tract of most importance for the present purpose is that partially surrounded by England, France, and Spain: and its temperature conditions are sufficiently well determined by the observations in these countries. By the aid of the isotherms plotted for each month by the French bureau of meteorology, the temperature of a definite portion of this region has been deduced for each month of the year. Line VI. of the table gives the mean temperature of 'winter' at St. Bernard for each of the five cases. Line VII. gives the mean temperature over the indicated portion of the Atlantic for the same periods and on the same assumptions. In lines VIII. and IX. the maximum tension of aqueous vapor in the atmosphere, expressed in millimetres of barometric pressure, is given for each of these temperatures; and the differences between these (X.) are taken as measures of the relative rates of precipitation under the various assumptions. Multiplying these rates by the corresponding numbers of line V., we obtain a series of numbers which measure the relative snowfall under the several assumptions. (For convenience these numbers have been multiplied by an arbitrary constant, so as to express them in terms of the present precipitation as unity.) For example: in the assumed case of a general temperature 6° lower than the present, the length of 'winter' is 327.7 days. At the present time the total precipitation in rain and snow during that period is 1.1576 metres; and in the assumed case the whole of this precipitation would be in the form of snow. This is notably greater than the present snowfall, .7491 metres: but the general rate of precipitation, affecting the whole year alike, would be less than the present in the ratio of 4.303 to 6.289; and these two factors, tending in opposite directions, so nearly neutralize each other that the total snowfall (XI.) in the assumed case differs by only 6 per cent from the actual.

The figures of line XI. show, for a thermometric range of 12° (C.), a variation of only 35 per cent in the snowfall, and indicate, that,

if the formation of glaciers depended exclusively on precipitation, it would not be greatly influenced by a general change of temperature. The actual influence is exerted chiefly through the agencies of dissipation; to the consideration of which we now pass.

The dissipation of the snow is accomplished partly by evaporation and partly by melting. Whether one process or the other preponderates, depends upon circumstances; and in the case under consideration we do not know their relative importance. We have therefore made separate computation of the ratios of melting and evaporation. Melting takes place only during the period we have designated 'summer'; and its rate during that period is measured by the mean temperature, expressed in centigrade degrees. If, therefore, we multiply the length of the 'summer' in each case by its mean temperature, we obtain a number indicative of its relative power to melt snow and ice. These numbers are given in line XIV., and exhibit a wide range; the rate of melting with a general temperature 6° higher than the present being nearly three times as great as the present, and the rate with a general temperature 6° lower than the present being less than the sixtieth part of the present rate.

Evaporation is not restricted, like melting, to the 'summer' period, but goes on during the entire year whenever the atmosphere is not saturated with vapor. Strictly speaking, its rate is measured by the difference between the amount of moisture actually in the air and the amount necessary to produce saturation. We have no direct means of ascertaining this rate for our assumed cases; but it seems reasonable to suppose that the relative humidity, or the ratio of mean actual vapor-tension to the tension due to saturation, would be the same in all the cases; and upon this postulate the rate of evaporation for each case is measured by the tension of saturation due to the mean annual temperature. These tensions are given in line XVI., and the deduced rates of evaporation in line XVII. These numbers do not increase so rapidly as those expressing the melting-power; but they indicate that the rate of dissipation by evaporation is doubled by a general rise in temperature of 9°.

Since, then, a rise of general temperature diminishes slightly the solid precipitation, and at the same time increases greatly both the rate of melting and the rate of evaporation, it is evident that it is not favorable to the formation of glaciers; and we shall obtain the same qualitative result, whatever we assume to be the relative importance of melting and evaporation. For the sake of reaching a definite quantitative result, we will make the arbitrary assumption that the snow now precipitated at St. Bernard loses two-thirds of its volume by evaporation and only one-third by melting. This gives for the ratios of dissipation the numbers contained in line XVIII. Dividing the relative snowfall (XI.) by the relative dissipation (XVIII.), we obtain the ratio of snowfall to snow-dissipation (XIX.) which may be taken to express the tendency to the formation of glaciers. This tendency appears to be increased two and one-half times by 6° lowering of general temperature, and diminished nearly two-thirds by a corresponding advance of temperature. Considering the entire range of temperature indicated by the hypotheses, each increment of 4½° doubles the conjoint power of evaporation and melting to remove the precipitated snow.

It is, of course, not imagined that this analysis takes account of all the climatic factors affecting the problem; but it is believed that no omitted factor can modify the qualitative result. One of the most important of the ignored considerations is that of the influence of rain upon the rate of melting. There is no way in which the heat of a warm current of air is communicated so rapidly to a bed of snow or ice as by means of the precipitation of rain; and, since rainfall is necessarily increased by rise of temperature, our results would be somewhat strengthened if this factor were taken into account.

Another factor of possible importance is connected with the velocity of air-currents. The circulation of the atmosphere is caused by differences of temperature, and these differences arise from solar heating; so that an augmentation of solar heat tends to accelerate the aërial currents. This acceleration would probably not be great for the range of temperatures here considered; nevertheless, it would be worthy of consideration if we were able to give a quantitative expression to its effects. One of these effects would be an increase of precipitation, including an increase of snowfall; another would be an increase of the rate of melting; and a third would be an increase in the rate of evaporation. In their relation to our results, these effects might perhaps neutralize one another.

The problem we have thus examined is by no means simple, and it is not impossible that some meteorologic fallacy lurks behind our figures; but, until it shall be pointed out, we are constrained to believe that one of Pro-

fessor Whitney's chief postulates is untenable.

Another postulate, and the one most essential to his general theory, is equally at variance with the ordinary belief of men, and is, in our opinion, equally erroneous. It will be considered in the third and final part of this article.

AMERICAN PALEOZOIC FOSSILS.

MILLER, S. A. *The American paleozoic fossils: a catalogue of the genera and species* (etc). Cincinnati, *the author*, 1877, 1883. 16+334 p. 8°.

THIS second edition of Miller's catalogue of American paleozoic fossils consists of the original list issued in 1877, with a consecutively paged supplement of some ninety pages. The work is essentially a catalogue of genera and species, with names of authors, dates, places of publication, groups of rocks in which the species are found, and the etymology and signification of the names applied to them. There is also an introduction to the stratigraphical geology of the paleozoic rocks, a chapter on the construction and application of names in paleontology (contributed by Prof. E. W. Claypole), and an explanatory preface to the original, and to the supplementary part. It is needless to dilate on the usefulness of a work of this kind, which commends itself at once to the notice of working naturalists, even those not especially devoted to paleontological studies. Catalogues and bibliographies, even when of inferior execution, are always welcome to the student as labor-saving tools, and when well done are invaluable. The testimony of experts in this case is to the effect that the work has been done with care and completeness; though, as in all such catalogues, it would be strange if there were not some omissions. In the way of criticism, we should say that the addition of the number of the page to that of the volume, or to its abbreviated title, would have been little additional labor to the industrious compiler, and would save much time to the person using the work as a means of reference, especially to old works which are often destitute of an index. Furthermore, except in the case of confessedly absolute synonyms, we believe it is better to express the compiler's view, that a certain generic or specific name is merely the equivalent of another, by a mark of interrogation preceding the sign of equality and the supposed prior name. In this way there is less liability to error in matters about which authors are not universally agreed, than when a positive statement is made on one or the other side. It would also be well if a bibliography of the works cited in the list, often by titles so condensed as to be difficult of recognition by those unfamiliar with paleontological literature, were to be added to the volume. These, however, are suggestions rather than criticisms; and we may supplement them by further suggesting that naturalists would be under still greater obligations to Mr. Miller, should his time and inclinations lead him to prepare similar catalogues for the later geological formations.

AUSTRALIAN CRUSTACEA.

Catalogue of the Australian stalk and sessile-eyed Crustacea. By WILLIAM A. HASWELL. Sydney, 1882. 24+324 p., 3 pl. 8°.

THE Australian museum has recently issued a list of Australian crustacea, much after the pattern of the list of New-Zealand crustacea, published six years ago. The present work is largely a compilation; the author for some reason usually preferring to copy the descriptions of authors, even when specimens were at hand, while the synonymy exhibits many proofs of a like treatment. There occur to us several species which should have been inserted in the list, but which appear to have escaped Mr. Haswell: these are, —

Paramicippa affinis Miers.
Halimus auritus Edwards. — (Pt. Philip, Kinahan, *Proc. roy. Dublin soc.*, i. 117, 1858.)
Lambrus latirostris Miers.
Leitocheira bispinosa Kinahan.
Pilumnopeus crassimanus A. Milne-Edwards.
Pilumnus deflexus A. Milne-Edwards.
Neptunus rugosus A. Milne-Edwards.
Thelphusa angustifrons A. Milne-Edwards.
Thelphusa crassa A. Milne-Edwards.
Gelasimus longidigitum Kingsley.
Gelasimus annulipes Edwards.
Ocypoda fabricii Edwards.
Ocypoda convexus Quoy et Gaimard.
Pachygrapsus transversus Gibbes (P. levimanus Stimps.).
Heterograpsus crenulatus Edwards.
Cyclograpsus tasmanicus Jacquinot et Lucas.
Macrophthalmus dilitatus Edwards.
Macrophthalmus definitus White.
Calcinus latens.
Alpheus bidens Edwards.
(Alpheus thetis White is merely mentioned, but not in such a manner as to imply that it belonged to the Australian fauna, as in reality it does.)

Still, leaving these deficiencies, the work will probably have a certain value for the students of Australia, as it brings together in a compact form descriptions of a large proportion of the crustacea of the antipodean continent.

J. S. KINGSLEY.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

GEODESY.

The lake survey. — There has just been issued by the chief of engineers, in a quarto of 920 pp. with thirty plates, a detailed report of the operations in the prosecution of the survey of the Great Lakes. This important work is now finished, and the report presents in a comprehensive manner the methods used and results obtained. While omitting the vast amount of uninteresting detail with which such works are usually encumbered, all important features are given mention; and the whole volume is indexed with such care that any particular subject may be instantly found. The report starts with a historical account of the survey, from its inception in 1841, to its completion; gives a synopsis of the work accomplished under the various officers who from time to time have had charge of the survey; gives an account of the standards of length upon which the surveys depend, of the measuring-bars used and methods of using them, and of the results obtained both in the measurement of the base lines and in the results of their connection by triangulation, and of the geodetic and astronomical work. The part devoted to the discussion of the base apparatus will be found of special interest to geodeticians. Full account is given of the determination of the constants of the apparatus used, and of the co-efficients of expansion. Also there is a discussion of the 'set' of a zinc bar when heated. A portion of the book is devoted to the consideration of the mean levels of the Great Lakes, and the methods by which the results were obtained. The question of tides in the lakes had been previously considered (*Report of chief of engineers, 1872*). The tides are perceptible, but of scientific rather than practical importance, the maximum being less than two inches. — (*Professional papers, corps of engineers*, no. 24.) H. W. B. [346

MATHEMATICS.

Elliptic-function formulas. — Integral forms are given for certain products and quotients of the elliptic functions cn*n*, cn*n*, and dn*n*. The author, Mr. Craig, starts out from a formula of Mr. Glaisher's for the second derivative of the function $cn^n u$. — (*Amer. journ. math.*, v., 1882.) T. C. [347

Intersections of circles and spheres. — Gen. Alvord gives geometrical solutions of the problems, — to draw a circle cutting three given circles at the same given angle, to draw a circle cutting four given circles at the same unknown angle, and the analogous problems for spheres. — (*Amer. journ. math.*, v. 1882.) T. C. [348

Symmetric functions. — Mr. Durfee has given tabulated values of the functions (of weight twelve) of the co-efficients of the twelfthic in terms of the symmetric functions of its roots, also the values of these symmetric functions in terms of the co-efficients. — (*Amer. journ. math.*, v. 1882.) T. C. [349

Elliptic functions. — This is the first part of a paper by Otto Rausenberger, in which he introduces a new idea into the theory of elliptic functions. Instead of, as usual, considering doubly periodic elliptic functions, he considers that an advantage is gained by considering what may be called transcendants, with simply multiplicate periods (*einfacher multiplicatorischer periode*); that is, functions satisfying the equation $f(px) = f(x)$. The notation which he has adopted is made to conform as nearly as possible with that employed by Königsberger in his '*Vorlesungen über die theorie der elliptischen functionen.*' He defines certain functions, $\eta_0, \eta_1, \eta_2, \eta_3$, which are analogous to the ordinary theta-functions, and gives the values of functions $S(p, x)$, $C(p, x)$, $D(p, x)$, which correspond in the ordinary notation to sn x, cn x, dn x, in terms of these η-functions. The equations are identical in form with those giving sn x, etc., in terms of the θ-functions. In conclusion a discussion of some of the properties of multiplicate periodic functions is given. — (*Journ. reine angew. math.*, xciii.) T. C. [350

Binary quintics. — An extensive discussion of the Hessian of the binary quintic is given by Mr. F. Lindemann. The expressions for the invariants and quadratic covariants of this sextic covariant, in terms of the invariants and covariants of the quintic to which it belongs, are obtained, and a relation found to exist between them, which is the necessary and sufficient condition that a given sextic may be the Hessian of a quintic. The typical expression of the Hessian by means of its quadratic covariants is next found. In the course of obtaining this, it is observed, that, when a certain invariantive condition is fulfilled, the quintic is reducible to a known soluble form. The remainder of the article contains the investigation of the peculiarities which attach to the Hessian on the supposition of any peculiarity in the quintic, and *vice versâ*; the determination of a quintic whose Hessian is given; and, finally, a geometrical interpretation of the condition satisfied by any sextic which is the Hessian of a quintic. — (*Math. ann.*, xxi. 1, 1883.) F. F. [351

Theory of numbers. — In an article on power-residues (*potenzreste*) F. Hofmann employs the device of representing the residues of the successive powers of a number with respect to a prime-number modulus as the successive vertices of a regular polygon inscribed in a circle, to prove Gauss's theorems concerning the sums of the primitive roots of the binomial congruence, $x^{p-1} \equiv 1$ (mod. p). He makes some remarks on binomial equations, and their connection with binomial congruences. — (*Math. ann.*, xx. 4, 1882.) F. F. [352

PHYSICS.

Acoustics.

Range of sounds in air. — Allard has deduced a formula for the intensity of a sound in terms of the work done in producing it (T), the rate of vibration (n), and the extreme range (x). The table given by him shows that the intensity of the sound in air decreases more rapidly than is indicated by the law of inverse squares. At the extreme range, all the sounds are reduced to the same intensity; while the values of $\frac{T}{x^2}$ vary, for the six instruments used, from 0.10 to 13.46.

A cause of this enfeeblement of sound is the reflecting action of the successive layers of air of different density when the atmosphere is not homogeneous. A formula is deduced which takes this action into account, which, with its constants determined from the experiments described, gives for a moderate acoustic transparency of the air, —

$$T\,(0.473)^x = 0.0000277\,n\,x^2.$$

The work necessary to cause a given increase of range, and the range of sounds of different pitch produced by the same expenditure of energy, can also be determined from the formula. The difference of

range for the extent of an octave is slight. — (*Comptes rendus*, Nov. 22, 1882.) C. R. C. [353

Heat.

Relation between latent heat, specific heat, and volume. — It is pointed out by Mr. Trouton that the latent heat of gasification at constant pressure of any body, divided by the product of the relative volume of the gas and the specific heat of the body, is approximately constant. This constant is calculated for many substances. The only marked exceptions are water and acetic acid. — (*Nature*, xxvii., No. 691.) C. B. P. [354

Exception to the second law of thermodynamics. — An ingenious method has been devised by Prof. H. T. Eddy to show that radiant heat is an exception to the second law of thermodynamics. The method is based upon the fact that heat is radiated, not instantaneously, but with a finite velocity, and consequently it is possible for occurrences to take place, during the exchange of radiations between two bodies, such as essentially to alter the ultimate distribution of heat. If three screens, composed of some perfectly reflecting material, are provided with suitable apertures, and are placed parallel between two radiating bodies, velocities can be communicated to the screens such that radiations from the first body will pass through the apertures to the second body, while the radiations from the second body will be intercepted, and reflected back. Thus, if the temperature of the first body is less than that of the second, heat can be transmitted from a colder to a hotter body without compensation, and without the expenditure of work.

The axiom of Clausius, that heat cannot of itself pass from a colder to a hotter body, and the similar axiom of Thomson, are thus only true with regard to radiations, if the velocity of radiation is infinite.

The arrangement employed by Prof. Eddy, which he calls the 'radiation siren,' proves that we can no longer regard the law of dissipation of energy of universal validity, and we cannot accept the principle of Clausius, that the entropy of the universe tends to a maximum. — (*Proc. Amer. phil. soc.*, xx. No. 112.) C. B. P. [355

Electricity.

Electric railways. — Professor Ayrton, in a lecture at the Royal institution, showed that the weight of a train on an electric railway would be comparatively small, because stationary engines would be used, and each pair of wheels on all the cars could be used as drivers. Hitherto the objection to the extension of electric railways has been, that the insulation of the rails used as part of the motive circuit was imperfect. Prof. Perry and the lecturer have devised an arrangement by which the passing train depresses a series of corrugated steel disks mounted on stands some inches above the track, and thus makes a carefully protected contact with the insulated main cables on each side; at the same time putting a temporary earth fault in an auxiliary wire, which records at the station the progress of the train. The track is divided into sections, from each of which the current is cut out while a train is on the section next in advance. If a train enters the section so cut out, its electromotors are shunted, so as to powerfully resist the motion of the train. The electric lighting of the cars is kept up, in such a contingency, by the automatic switching-in of Faure batteries. — (*Nature*, Jan. 11.) J. T. [356

Wimshurst's electrical machine. — Two circular glass plates 14½ inches in diameter, and ⅛ of an inch apart, with 12 brass strips cemented on the outside of each at equal angular intervals, rotate in opposite directions on the same axis. Opposite strips on the same plate are connected once in each revolution by a curved metallic rod terminated with brushes. The electricity is collected by combs opposite the horizontal diameter. With the instrument described, under ordinary atmospheric conditions, a 4½-inch spark was obtained once in every 2¼ revolutions. The only apparent exciting cause is the friction of the air between the plates. — (*Engineering*, Jan. 5.) J. T. [357

New telephone receiver. — S. P. Thompson has devised an improvement on the instrument of Philip Reis, who utilized the sound emitted by a magnetized bar due to fluctuations in the magnetizing circuit. The improvement consists in making the magnetized core slender and subject to adjustable tension, and attaching one end to a suitable vibrating plate. In one form two cores are used, one being of nickel, which contracts when magnetized; the opposite movements being used to increase the distortion of the membrane. It is claimed that articulation, especially of sibilants and certain other consonants, is more distinct with this than with the common receiver. — (*Engineering*, Jan. 26.) J. T. [358

Value of the Siemens unit. — E. Dorn, by a modification of Weber's second method by which he eliminates the influence of terrestrial magnetism, establishes the relation

$$S\ .\ U = .94825 \times 10^{10}\ \frac{\text{mm.}}{\text{sec.}},$$

and compares this result with those of other observers in this table: —

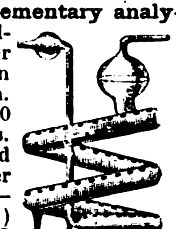
Lorentz	.9333	[1]Brit. Assoc.		.9530
Rayleigh	.9413	[1]Rowland	from	.9431
Kohlrausch	.9440		to	.9459
H. F. Weber	.9550	Dorn		.9483

(*Ann. phys. und chem.*, xvii. 13.) J. T. [359

CHEMISTRY.

(*Analytical.*)

Absorption apparatus for elementary analysis. — For absorption of the products in organic analysis, C. Winkler proposes the spiral apparatus shown in the accompanying illustration. It should be capable of holding 20 grms. of sulphuric acid or 15 grms. of potassium hydrate solution; and it may be used to absorb either water or carbonic dioxide. — (*Zeitschr. anal. chem.*, 1882, 545.) C. F. M. [360



Separation of barium from strontium or calcium by potassium chromate. — J. Merscherzerski finds that barium chromate is soluble in 23,000 parts water, more soluble in acetic acid, and it has a great tendency to carry down other salts from the solution in which it is precipitated. Since strontium chromate requires 840 parts water for solution, it would be precipitated in a solution containing more than one per cent. The author therefore concludes that this method affords a convenient and sufficiently accurate means for a qualitative separation; but it cannot be relied upon for quantitative purposes. — (*Zeitschr. anal. chem.*, 1882, 399.) C. F. M. [361

[1] These results depend on the ratio, given by Kohlrausch, $\frac{\text{B. A. unit}}{\text{S. unit}} = 1.0493$.

Testing for barium or sulphuric acid. — The minimum strength of a solution of barium chloride in which barium can be detected with certainty, according to S. Pickering, is 1 part barium in 833,000 parts water; and the re-action is equally delicate with sulphuric acid or ammonium sulphate. The precipitation was observed against a black background by means of an artificial light placed almost vertically above the test-tube. — (*Chem. news*, xlvi. 223.) C. F. M. [362

Estimation of sulphur in iron and steel. — G. Craig meets with good results by passing the gases evolved with hydrochloric acid through an ammoniacal solution of hydrogen peroxide. — (*Chem. news*, xlvi. 199.) C. F. M. [363

Detection and estimation of titanium. — A. Weller finds that the change in color produced when titanic acid is formed by oxidation of the sulphate with hydrogen peroxide is sufficiently delicate to render the re-action a suitable means for the determination of titanium. — (*Berichte deutsch. chem. gesellsch.*, xv. 2592.) C. F. M. [364

Estimation of titanic acid in presence of iron. — A method proposed by Pasani for the volumetric analysis of a solution containing titanic acid and iron depended upon his observation that the acid oxide of titanium (TiO_2), when reduced to the sesquioxide (Ti_2O_3) by nascent hydrogen, could be completely oxidized by potassium permanganate, even in presence of iron in the ferrous condition. According to E. Wiegand, this method is incapable of giving constant results. He finds that ferrous oxide undergoes partial oxidation before oxidation of the titanic sesquioxide is complete, and therefore infers that ferric oxide and titanium sesquioxide can exist in the same solution. — (*Zeitschr. fur anal. chem.*, 1882, 510.) C. F. M. [365

Volumetric analysis of peroxides. — A comparison of Bunsen's and Mohr's methods for the determination of available oxygen in peroxides by W. Diehl shows that digestion with hydrochloric acid and potassium iodide, recommended by Mohr, gives as exact results as the distillation in Bunsen's method. Digestion with acetic instead of hydrochloric acid affects as complete decomposition of manganese dioxide, either freshly prepared or in pyrolusite; and at the same time potassium iodide is without action upon ferric acetate. The available oxygen and the percentage of iron in manganese dioxide may therefore be ascertained by two determinations, in one of which hydrochloric acid is used, and in the other acetic acid. In lead peroxide the available oxygen may be as accurately determined by digestion with acetic acid and potassium iodide as by Bunsen's method. — (*Dingler's polytechn. journ.*, 246, 196.) C. F. M. [366

METALLURGY.

The Siemens direct process. — This consists in heating mixed fine iron-ore and coal in a horizontal, slowly revolving cylinder. The iron forms a sponge ready for rolling, while the silica and earthy impurities form a slag, which removes the hurtful sulphur and phosphorus from the iron. Mr. James Davis of Landore, Wales, gives his experience. He makes one ton of wrought iron with one ton of gas-producer coal, reduces the sulphur to a trace, and the phosphorus to .05 per cent. He finds magnesia bricks to stand the best. In 32 days 21 hours net working time, with 200 heats, using 200 tons of ore and 120 tons hammer scale, he made 217 tons 5 cwt. of blooms. — (*Eng. and min. journ.*, Jan. 6, 1883.) R. H. R. [367

Recovery of precious metals from slags. — A patent has been obtained by Mr. Richard Pearce of Denver, on an improvement in smelting gold and silver ores. The process consists in throwing upon the slags, as soon as the charge is perfectly melted, a fine-powdered oxide of copper or roasted copper matte. The furnace is then closed a short time. A reaction takes place, and a matte descends, thereby robbing the slag of its precious metals. For a charge of 3 tons of ore, 30 lbs. of oxide of copper are needed. — (*Min. and sc. press*, Dec. 16, 1882.) R. H. R. [368

Basic open-hearth steel process. — Mr. O. T. Tellander has described the adaptation of this process at the Alexandrowsky steel-works, St. Petersburg, Russia. The steel is made from pig-iron, scrap-iron, spiegel, and ferro-manganese, which are melted in the usual Siemens-Martin furnace. The special feature of the basic process consists in lining the furnace with bricks made of dolomite mixed with 18 per cent of coal-tar. The joint between this lining and the outer Dinas bricks is made by a layer of chrome-iron-ore and coal-tar. A mixture containing .5 per cent of phosphorus yields steel with an average of only .04 per cent. The sulphur is also reduced as much, while the silicon is almost entirely removed. — (*Eng. and min. journ.*, Jan. 13, 1883.) R. H. R. [369

AGRICULTURE.

Value of sprouted and dried seeds. — Experiments by Will led to the following conclusions: —

1. Mature seeds of common cultivated plants suffer no diminution of the proportion of seeds capable of sprouting, if soaked twelve hours in water, and then dried at ordinary temperatures. Some samples of peas constituted exceptions to this rule. Soaking twenty-four hours, and then drying, usually caused a slight decrease in the percentage of seed which germinated.

2. Some seeds even survive an interruption of germination in its first stages. The radicle dies, but is replaced by adventitious roots. The plumule is more enduring: even when the terminal bud is destroyed, lateral buds may develop.

3. The proportion of seeds capable of regermination is, in general, inversely proportional to the extent to which germination has progressed.

4. The extent to which the first germination may be carried varies in different kinds of seeds. Monocotyledonous seeds seem, in general, to withstand this treatment better than di-cotyledonous.

5. In view of the fact that such seeds germinate only under the most favorable conditions, the use of seed that has once been germinated is not to be recommended in practice. — (*Landw. versuchs-stat.*, xxviii. 51.) H. P. A. [370

Prevention of potato-disease. — According to Jensen, this disease, which is caused by a fungus (Peronospora infestans, Tul.), attacks first the tops, and is conveyed to the tubers by means of spores washed into the soil by rain. He therefore proposes to prevent this by running a plough between the rows, so as to throw up a furrow upon the top of the hills, while at the same time the tops are bent over so as to hang above the neighboring furrow. This should be done at least as soon as the disease shows itself on the tops; usually by the middle of August. In this way the washing of the spores into the hill is prevented. Furthermore, the potatoes should not be dug for at least two or three weeks after the tops are entirely wilted, to avoid infection from the latter. Field experiments with this method gave very favora-

ble results. — (*Biedermann's centr.-blatt.*, 1882, 755.) H. P. A. [371

GEOLOGY.

Impressions on Potsdam sandstone. — At the meeting of the Natural history society of Montreal, Feb. 26, Mr. Walter Ferrier exhibited specimens of some new trails and impressions of animals from the Potsdam of Rainbow Falls, near Au Sable chasm on Lake Champlain. One of them is a cast of two narrow furrows about a quarter of an inch apart, with a rim of punctiform impressions about an inch distant at either side. This impression is repeated in two places on a ripple-marked slab. It may be the track of a trilobite with two prominent spines on the pygidium, possibly of some species of Dikellocephalus. Another is a trail about an inch in width, marked with transverse furrows and ridges, perfectly simple, and without any median ridge. In this last respect they differ from the trails known as Rurichnites, Cruziana, Arthrichnites (Arthrophycus), and Traena. They resemble, though on a larger scale, impressions from the Erian sandstone of Gaspé, of which a slab from the collection of Dr. Dawson was exhibited for comparison. Such impressions, destitute of a central ridge, may have been made by gasteropods or by worms without any abdominal furrow. The name Clydichnites (wave-tracks) has been proposed for them by Dr. Dawson; and the Potsdam and Erian forms must belong to two distinct species. — J. W. D. [372

Newfoundland geology. — The report of progress of the Geological survey of Newfoundland for the year 1881 contains a report of Mr. J. P. Howley on the structure of the peninsula of Avalon. He finds that the major part of the peninsula is made up of the various divisions of the Huronian or Intermediate system, as given in the report for 1868, resting upon a nucleus of gneiss, and succeeded by the fossiliferous beds of the primordial Silurian or Taconic, which skirt the shores of the bays, and form most of the islands therein. In division *d* of the Huronian system the fossils Aspidella terranovica and Arenicolites spiralis occur. He recognizes two large intrusive masses of plutonic rocks, — one in the eastern, and the other in the western peninsula. That in the eastern peninsula he considers the older, as it has not affected the primordial strata, as has been the case in the western peninsula. The eruptive mass between Salmon cove and Collier's bay he considers as having been formed prior to the deposit of the higher members of the Huronian system, as the strata intersected are confined to the lower divisions, *a* and *b*. Mr. Howley failed to discover, in the auriferous quartz-veins of division *c*, a single example of visible gold. Some copper ores were found, mostly in divisions *a* and *b* of the Huronian system. Near Little Placentia, some argentiferous galenite occurred, which yielded, on analysis, 159 ounces of silver to the ton (2,240 pounds) of ore. Accompanying the report is an appendix with three plates, containing descriptions and figures of primordial fossils, by the late E. Billings. These figures and descriptions have already been published (*Geol. surv. Can.*, *pal. foss.*, 1874, ii. 1). A geological map on a scale of four miles to the inch, and showing very plainly the distribution of the formations, accompanies this report; also a section-map showing the corrugations effecting the stratification of the Huronian formation near Brigus, Conception bay, on a scale of four inches to a mile, surveyed by J. P. Howley. — J. B. M. [373

Lithology.

Hunting for lost glaciers with a microscope. — Considerable work has been done in this direction in Germany and elsewhere by various observers, — work with which geologists are more or less familiar.

In the present paper the results of an extended study of the plagioclase rocks and phonolites of the Mecklenburg drift is given by one of the prominent young German lithologists, — Dr. Eugen Geinitz, of the Rostock university. Geinitz' method consists in examining thin sections of the rocks found in the drift, and comparing them with the descriptions given by the Scandinavian lithologists of rocks known *in situ* in that peninsula. In this way various basalts, diabases, gabbros, diorites, and phonolites are referred to certain localities in Sweden, whence they are supposed to have been derived. Interesting results can be obtained by such methods; but they are often uncertain, since it cannot be predicated that rocks of the same character do not exist, or have not existed, in the intermediate drift or water-covered areas.

The paper is a valuable one on account of the extended descriptions of the rocks examined. — (*Nova acta acad. leop.-carol.*, xlv. 35.) M. E. W. [374

Hypersthene-andesite. — The chief pyroxene of an apparently typical 'augite-andesite' from Buffalo Peaks, Col., was found by Whitman Cross to be hypersthene, both from its optical properties and chemical composition. The mineral was isolated for analysis by treating the rock powder with HFl, which dissolved the feldspar, glass base, and finally the augite, leaving only the hypersthene (richer in iron than augite) and ore particles. The latter, being magnetite, were separated by a small magnet. The microscopic examination of many European and American augite-andesites of the same type seems to prove that they, likewise, contain more rhombic pyroxene (hypersthene) than augite; and Cross claims that they should be separated from other andesites, and called 'hypersthene-andesites.' Nearly all other so-called augite-andesites have more of the trachytic habitus, and are so nearly related to hornblende and mica-bearing andesites, that, according to the writer, they cannot be consistently separated, and considered as a distinct group. Should the determination of hypersthene in this sub-group of the andesites be confirmed, a very interesting, widely distributed, and well defined rock-type will have been discovered. — (*Amer. journ. sc.*, Feb., 1883.) S. F. E. [375

METEOROLOGY.

Iowa weather service. — Mr. Gustavus Hinrichs has issued an almanac for 1883, under the title of Iowa weather service annual, giving, in addition to the ordinary calendar, a summary statement of the climate of Iowa, illustrated by several diagrams. The mean temperature for Iowa City is, for the winter months, 25°; for the summer, 72°. The barometer is highest in December, lowest in April and June. The winds are strongest in March and April, being mostly westerly or north-westerly in winter, often easterly in spring, southerly or calm in summer, and westerly in autumn. Besides the general cyclonic storms, Iowa has the 'blizzard,' an intensely cold, high wind following a winter thunder-storm; the tornado, commonest in June, but occurring from March to October; and the squall, a sudden north-westerly wind with heavy clouds and rain, following sultry weather with light southerly winds. Precipitation is greatest from June to August, and least in December. It is shown on monthly maps compiled from 26,082 measures from 1876 to 1880. It is least in the north-west (26″), heaviest in the south (36″) and east (38″), and seems to be "dependent on the distribution of

the timber in the State, being greatest where the timber is most abundant." — W. M. D. [376

GEOGRAPHY.

(South America.)

Brazilian coast. — R. A. Hehl describes the physical peculiarities of this coast, between 21° and 23° south latitude, under the headings of shore-lagoons, rivers, neighboring mountain ranges, and lowlands. — (*Peterm. mittheil.*, 1882, 443.) W. M. D. [377

Fontana's unsuccessful search for Crevaux. — The Argentine expedition under Fontana, sent last July in search of the remains of Crevaux and his party, who were lost on the Pilcomayo some months earlier, has returned to Buenos Aires without any information of the unfortunate explorers. It is concluded that any expedition, to be successful, must attempt the river from its head waters, whence a voyage down stream would require only four or five months; while, in ascending the river, at least ten months would be needed, and many great difficulties would be encountered. — (*Comptes rendus soc. géogr. Paris*, 1882, 466.) W. M. D. [378

Rumor of Crevaux's survival. — M. Milhôme, a French settler in the province of Tarija, Bolivia, wrote last October that he was convinced that some of Crevaux's party were still alive, and held as slaves by the Tobas Indians. He had seen one of the party, named Zeballos, who had escaped the reported massacre, and who had seen another, named Blanco, kept as a prisoner. Moreover a cacique had brought information to Milhôme that the Indians had some white men as prisoners, and were learning the use of arms from them. — (*Compt. rend. soc. géogr. Paris*, 1883.) W. M. D. [379

(Africa.)

Wissmann's trip across Africa. — At a meeting of the Khedival geographical society (Cairo) on Jan. 19, Lieut. Wissmann read a paper on his recent journey across equatorial Africa, stating, that, in company with Dr. Pogge, he had left Mukenge's town in the Tushilange country on Dec. 1, 1881, and crossed an unexplored country to the eastward as far as the Arab settlement Nyangwe, on the Lualaba, arriving there April 16, 1882. The route led them across the Lulua, Muansangoma, Lubilash, and Lomani rivers; and to the east of the last they came upon the route that Cameron had followed westward nearly ten years before. None of the large lakes previously reported in this region were found or heard of, except the Munkamba, which proves to be a small lakelet hardly three miles in length. It is fed by springs, and has no outlet, and lies at an altitude of 2,230 feet, in lat. 5° 45′ S., long. 22° 55′ E. Dr. Pogge at once returned westward from Nyangwe, but has not yet been heard from. Wissmann, after staying two months on the Lualaba, started eastward by a beaten track to Lake Tanganyika, which he crossed to Udjidji, and then passed by way of Tabora to Zanzibar on Nov. 17. His entire journey from sea to sea occupied twenty-two months. — (*Athenaeum*, Feb. 3, 1883.) W. M. D. [380

Pogge and Wissmann. — B. Förster prepares for an account of the journey of these explorers across the Kongo basin and the lake-district by a review of the results of the earlier journeys in the same field by Livingstone (1852–54), Cameron (1874), Stanley (1876), and the travellers of the German-African association in the southern Kongo basin, within the last ten years. This is followed by a summary of Pogge and Wissmann's observations as far as Mukenge. — (*Ausland*, 1883, 33, 117.) W. M. D. [381

(Atlantic Ocean.)

Eruption of Teneriffe. — C. Piazzi Smyth learns from private advices, that for several months past there has been no snow on the upper part of the peak of Teneriffe, although the rest of the high land has been whitened, as is usual at this season, and that more recently (in January?) 'fire, like three great bonfires,' had been seen on the summit of the peak, and a lava-stream had begun to flow down it. Previous eruptions are recorded about 1582; again in 1703 from the side of the peak, giving forth lavas that threatened the town of Guimar, on the south, and destroyed Garachico and filled its bay, on the north; and, finally, in 1798, from the western side of the mountain away from the peak. — (*Nature*, Feb. 1, 1883.) W. M. D. [382

BOTANY.

Action of fungi on cane-sugar. — M. Gayon, in experimenting with Mucor circinelloides, found, that, in the absence of free oxygen, this fungus forms spherical cells, which produce alcoholic fermentation in beer-wort, grape-juice, and solutions of glucose and levulose, precisely like brewer's yeast; but, unlike that ferment, the Mucor produces no change in cane-sugar. But if a band of paper impregnated with invertine, or a fungus capable of producing invertine, as Penicillium, is introduced into a solution of cane-sugar, the Mucor is then able to produce an alcoholic fermentation. It is now known that several species of Mucor are not able to invert cane-sugar; and the same is true of Saccharomyces apiculatus. M. Gayon suggests an ingenious method of separating cane-sugar from other sugars, as in molasses, by fermenting with the Mucor, which leaves the cane-sugar unchanged and crystallizable, while, if brewer's yeast were used, all the sugar would disappear. — (*Ann. sc. nat.*, xiv. 46.) W. G. F. [383

Development of Ascomycetes. — In order to decide the question of the sexuality of the Ascomycetes, C. Fisch has studied the formation of the asci and perithecia in the Pyrenomycetes. The principal genera studied were Polystigma, Xylaria, and Claviceps. In the first-named genus he finds that there are ascogons and trichogynes, which bear a strong resemblance to the organs of the same name found by Stahl in the lichen genus Collema; but, although spermogonia exist in Polystigma, Fisch could not be certain of a union of spermatia with the trichogyne, as was seen by Stahl in Collema. In Xylaria and Claviceps, however, he could find no evidences of sexuality, and the asci arose directly from the hyphae. Adopting the view advanced by DeBary in his paper on Saprolegniaceae, Fisch inclines to the belief that in the Pyrenomycetes we have a family in which apogamy exists as a rule, although in some cases, as in Polystigma, there is a connection with families in which there is a distinct sexuality. — (*Bot. zeit.*, Dec., 1882, Nos. 49–51.) W. G. F. [384

Structure and movements of leaves. — The relations between particular structural features in certain leaves to the phenomena of nyctitropic or sleep movements, and to those of movements following shock, must receive increased attention on account of recent papers by Gardiner and Cunningham. The former gave an account of his discovery (*Quart. journ. of micr. sc.*, Oct., 1882) that the protoplasm in adjacent cells of the *pulvinus*, or cushion at the base of the petiole, of Mimosa pudica, is continuous; the continuity being maintained by protoplasmic filaments which pass through pits in the cell-walls. In a more recent paper (*Proc. roy. soc.*, Nov., 1882) Mr. Gardiner states that he has now found the same pe-

culiar structure in the leaves of Robinia and Amicia; and he hints that the cases of continuity in protoplasm are numerous, being found not only in the *pulvini* of leaves, but in stems, roots, and tubers. Hugo de Vries found, that, when fresh, uninjured cells are treated with some neutral salt (say, potassium nitrate) in progressively stronger and stronger solutions, the protoplasm steadily contracts, until, with a 10% solution, it appears as a shrunken vesicle lying in the cell-cavity. In repeating these experiments, Mr. Gardiner finds, that, in a great number of instances, the contracted protoplasmic mass is connected with the cell-wall by fine protoplasmic threads. Moreover, the connecting-threads exhibit nodal thickenings, each node presenting a most perfect spherical form; and in several cases he has seen the threads in two adjoining cells exactly opposite each other. The method of treatment for this most interesting demonstration consists in subjecting thin, fresh sections to the action of a saturated solution of picric acid, washing with alcohol, and staining with aniline blue. Mr. Cunningham's paper is known to us as yet only through an abstract (*Proc. roy. soc.*, Nov. 16). From this abstract, which has been shortened as much as is consistent with clearness, we quote the following points: "The contractile organs, which are the chief determinants of movement, are, throughout the entire series of leaves, specially characterized by the porous nature of their component tissues. The porosity is very various in degree in different cases, and, according to the extent to which it prevails, converts the entire pulvinar organs, to a greater or less degree, into masses of a spongy texture, specially fitted to allow of the ready distribution of fluid contents. In those cases where it is most highly developed, as in Mimosa pudica, the pulvinar parenchyma is composed in greater part of finely porous cells, and in some portions contains masses of cells, which, in addition to the fine pores, are provided with one or more ostiola, — rounded openings with thickened margins." Again: it is asserted that the rapidity and magnitude of the movements in individual cases bear a direct relation to the degree of development of such structural features. — G. L. G. [385

Functional differentiation in stamens. — Dr. Müller shows that some endogens possess staminal differentiations in the same flower analogous to those previously recorded in Melastomaceae. Species of Tinnantia and Commelyna are figured, in which the three upper stamens are shorter and more highly colored than the lower ones, the quantity of pollen they produce being at the same time lessened. Their function is clearly to attract insects, and supply them with food. The remaining stamens and the pistil are so situated that insects must effect crossing while collecting pollen from the short stamens. — (*Nature*, Nov. 9.) W. T. [386

ZOÖLOGY.

Coelenterates.

The nervous system of hydroids. — According to Jickeli, the ganglion-cells of Eudendrium may be seen without difficulty in a surface view of a tentacle which has been hardened in osmic acid, and stained with picrocarmine. They are granular cells, situated between the bases of the ectoderm-cells, and sending off long processes which may join processes from adjacent ganglion-cells, or they may run to nettle-cells, or in among the muscle-fibres. In some cases a process from a ganglion-cell could be traced upwards, between the ectoderm-cells, to a small, spindle-shaped 'sensory cell' near the surface. The ganglion-cells are most easily seen on the tentacles; but they are also found on the body, the hypostom, and the glandular ring around the base. They are especially abundant in the stem of Eudendrium; and Jickeli believes that those found in the hydranth are developed in the stem. On the hydranth the ganglion-cells are sometimes aggregated in groups, and there is an indefinite nerve-ring around the base of the body. Jickeli has also succeeded in detecting the ganglion-cells of Hydra, although they are by no means so conspicuous as they are in Eudendrium. They are less granular, the nucleus is much larger, and the processes are more numerous. They are found in the ectoderm of all parts of the body, and they are usually situated among the groups of nettle-cells. — (*Zool. anz.*, no. 102; *Morph. jahrb.*, viii. 380.) W. K. B. [387

Histology of hydroids. — In addition to his interesting account of the nerve-cells of Eudendrium and Hydra, Jickeli describes other histological features of these two genera, especially the gland-cells and nettle-cells. In Eudendrium, the nettle-cells are most abundant in the stem; and he believes that this is the only place where new ones are formed, and that each hydranth receives its full share when it is formed as a bud. In Hydra each nettle-capsule is almost enclosed by a nucleated cell, which corresponds to the network of muscular fibres described by Chun in the Siphonopherae, and which sends muscular processes into the layer of muscle-fibres formed by the ordinary epithelio-muscular cells.

He points out the fact that the various species of Hydra may be identified by their nettle-cells alone.

The paper also contains a discussion of Kleinenberg's *neuro-muscular* cell theory, and a bibliography of the minute anatomy of hydroids. — (*Morph. jahrb.*, viii. 373.) W. K. B. [388

Crustaceans.

Breaks in the exoskeleton of decapod Crustacea at the time of moulting. — The apodemes of the exoskeleton, which form the sternal canal enclosing the chain of nervous ganglia in the Macrura, cannot be shed entire at the time of exuviation, as they have been said to be, without breaking the principal cords of the nervous system; and F. Mocquard finds, on examining the exuviae of Palinurus and the common lobster, that there is, in fact, a solution of the continuity of the apodemes along the median line at the time of moulting. He has not examined exuviae of Brachyura, where there is no proper sternal canal, but observes that the disposition of the venous sinuses necessitates the rupture of the apodemes at the time of moulting. — (*Comptes rendus*, Jan. 15, 1883.) S. I. S. [389

Origin of the species of Ocypoda from the Bonin islands. — Among some specimens of Ocypoda from the Bonin islands, Mr. Ishikawa is quite certain he sees 'specific differentiation going on before our eyes' in the varying length of the ocular stylet, and some other slight differences. The specimens are said to be closely allied to O. arenaria; but the figures which accompany the paper show that they are really very different, that they probably belong to two well-known Pacific-ocean species (O. ceratophthalma and O. cordimana), and that the supposed 'stepping-stones' between the two forms are only well-known variations of the former species due mostly to age and sex. — (*Amer. nat.*, Feb., 1883.) S. I. S. [390

Insects.

Habits of the basket-worm. — Prof. William Macfarland called attention to two important facts in the history of Thyridopteryx ephemeraeformis. When large trees are inhabited by them, only the small ends

of the twigs become their winter habitat. The arbor-vitae, and small trees with many slender branches, are their favorite resorts, and, when once attacked, are frequently destroyed. After the basket is well constructed, they have few enemies; but so persistent are these few that they nearly exterminate the basket-worm. At least seventy-five per cent are annually consumed by very small ichneumon flies, about one-eighth of an inch in length. Only about five per cent of those opened had ovaries filled with eggs.

Most of the T. ephemeraeformis thus infested with parasites are pupae; but some are found in the imago state, when the eggs have become the favorite food, and are wholly consumed.

There is only one brood annually; and, from what has been observed, it is quite evident that all shrubs and trees may be ridded of these pests by picking the cases off during the winter or early spring. — (*Trenton nat. hist. soc.; meeting* Feb. 13.) [391

Fertile eggs from a dead moth. — Mr. F. G. Schaupp states that last July he captured a ♀ of Arctia virgo, and obtained about a dozen eggs. As the specimen was useless for the cabinet, having lost half a wing, he dissected the abdomen, and found about fifty eggs therein, sticking together. After washing them with tepid water, he put them in a hatching-box, and in due time about twenty young larvae made their appearance. Could the same thing not be done when capturing a poor ♀ of a rare species? — (*Brookl. ent. soc.; meeting* Feb. 3.) [392

VERTEBRATES.

Relation of spinal-cord nerve-cells to fibres in the spinal nerves. — A careful enumeration of the large 'motor cells' in the anterior cornua of the spinal cord of the frog, and of the number of nerve-fibres in the anterior and posterior roots of the spinal nerves, has been made by Birge. He finds that there are just as many motor cells in the cord as fibres in the anterior roots, and that in regions where the fibres joining the cord are numerous, the motor cells are proportionately increased in number. When an individual shows some abnormality in the distribution of nerve-fibres between its anterior roots, a corresponding irregularity is found in the cells of the anterior cornua. It is therefore almost certain, that each motor nerve-fibre has its own single nerve-cell as its central organ, and that these cells lie in the spinal cord near the level at which their fibres join it. As the frog grows, the number of nerve-cells in the anterior horns of the gray matter, and the number of fibres in the anterior spinal roots, increases, proving a continued development of motor cells and motor fibres as the muscles increase in mass.

In any given specimen the fibres in the sensory roots are more numerous than those in the motor. The sum of the fibres in the anterior and posterior roots of a spinal nerve is equal to the number of fibres in the common trunk formed by their union beyond the ganglion of the posterior root. Hence, in traversing its ganglion, the sensory root experiences no increase or diminution in the number of its nerve-fibres. — (*DuBois' Archiv.*, 1882, 435.) H. N. M. [393

Irritability of motor-nerve cells in the spinal cord. — If parts of the spinal cord of the frog be cut or pricked, tetanus occurs in certain groups of muscles. Such tetanus does not follow cutting or pricking a nerve-trunk. Working with special apparatus, and with methods making it possible to ascertain exactly what part of the spinal cord was pricked, Birge finds that in the region of the spinal cord from which the sciatic plexus originates, the insertion of a needle-point only causes tetanus (with rare exceptions) when the needle has passed through the region of the gray matter in which the motor cells lie. Pricking the gray matter elsewhere has no effect on the muscles, or only causes a 'twitch' instead of a tetanic contraction. He concludes that the motor cells are capable of direct mechanical stimulation, and that a momentary stimulus throws them into a state of activity which lasts longer than the application of the stimulus. As his previous work (see 393) had made it pretty certain that each motor fibre ended in one definite motor spinal-cord nerve-cell, he concludes that any normal stimulus (voluntary or reflex), acting in the ordinary working of the body on the motor cells of the spinal cord, will, no matter how transient it may be, cause, not a twitch, but a tetanic muscular contraction of longer or shorter duration. — (*DuBois' Archiv.*, 1882, 481.) H. N. M. [394

Influence of respiratory movements on arterial pressure. — In a previous work Schweinberg had shown that in dogs the normal respiratory variations of arterial pressure disappeared upon cutting the phrenics. He concluded that the variations were due to changes of intra-abdominal pressure, dependent on diaphragmatic contractions and relaxations. If this be so, the respiratory curves of arterial pressure ought to disappear even with intact phrenics, if all circulation through the abdominal arteries be prevented: this Schweinberg finds to be the case. When the thoracic aorta is tied above the diaphragm through an opening made in the back of the thorax with care to leave the pleurae intact, then, unless the breathing becomes forced and abnormal, all the respiratory variations of arterial pressure cease. — (*Arch. für physiol.*, 1882, 540.) H. N. M. [395

The fatigue curve of striated muscle. — A short paper on this subject by Valentin contains as its chief novelty the fact that repeated feeble exercises of functional activity by a frog's muscle through which no blood is circulating aid in restoring the fatigued organ, so that subsequent contractions become more powerful. — (*Pflüg. arch.*, **xxix.** 506.) H. N. M. [396

Birds.

Germinal disk of birds. — Gasser has published an article containing several matters of interest. He first supplements his previous observations on the neurenteric canal, and reviews Kupffer's work. He still maintains that in birds "the primitive groove first becomes distinct on the anterior part of the primitive streak, and there becomes deepest; this deepest part corresponds to the spot where in many bird embryos the perforation of the neurenteric canal subsequently occurs." He then passes to the consideration of Koller's investigations, whose conclusion is, that the primitive-streak is normally preceded by a '*sichel*' (a crescent-shaped thickening of the inner germ layer on the edge of the *area pellucida*). On the contrary, Gasser maintains that the '*randwulst*' is thicker behind than in front, and the thickened portion may present sometimes in surface views the figure of a crescent, and that a *sichel* as a structure distinct from the *randwulst* is not proved by Koller to exist. Further Gasser argues against Koller's assertion that the primitive streak grows forward out of the supposed *sichel*; and he declines to admit any morphological importance for the groove, which is occasionally found in the *randwulst* (Koller's *sichel*), and upon which Koller lays such stress. Next follows a brief notice of Balfour and Deighton's paper. The remainder of the article is occupied by the author's own recent investigations on the chick, goose, and dove,

concerning the origin of the primitive streak. In a series of five chick-embryos, 5–8¾ hours incubation, the first important development noted was in the entoderm, which in the front part of the *area pellucida* remains thin, while in the posterior part it is thickened, until at the edge of the *opaca* behind it is five or six layers of cells thick. In the next stage there is a short primitive streak (but without its cephalic process) within the *area pellucida*, and formed essentially by the thickened outer germ-layer. The inner layer now includes both mesodermic and entodermic elements, and does not correspond to the definite entoderm of later stages. Around the edge of the germinal disc the upper layer bends over, and is united with the inner layer; the bend marks the germinal wall and later *randwulst*, which is thickened posteriorly, forming Koller's *sichel*, which is not a distinct structure. The inner layer forms one mass with the germinal wall, and it is probable that the latter furnishes the cells to thicken the former. The thickening of the inner layer may be best interpreted as a step towards the formation of the mesoderm. Gasser also reports in detail his observations on the goose and dove. Unfortunately the memoir is without plates, and contains no summary of the author's conclusions. — (*Arch. f. anat. physiol.; anat. abth.*, 1882, 359.) C. S. M. [397

Colors of feathers.— In continuation of previous communications Dr. Hans Gadow discusses the colors which are not the result of pigments: blues he considers to be the result chiefly of a series of fine lines on the walls of the prism cells; greens as the result, most often, of decomposition of light from a yellow pigment; metallic feathers are considered to work on the simple principle of a prism. — (*Proc. zoöl. soc. Lond.*, 1882, iii.) J. A. J. [398

Mammals.

Notochord of mammals. — Strahl in the paper above noticed showed that the neurenteric canal appears in the anterior end of the primitive streak, and that its wall is concerned in the formation of the notochord. His observations refer to lizards. Lieberkühn has found a canal in guinea-pig embryos, which occupies a similar position, and leads to the formation of the notochord (*chorda dorsalis*). This canal is, therefore, probably homologous with that of lizards, although it is developed in the interior of the mesoderm without connection with the ectoderm. Lieberkühn's views on the early development of mammals may be summarized as follows: After the completion of segmentation, fluid accumulates between the outer cell layer and the inner cells in such manner that the latter finally mark out the embryonic disk, which accordingly consists of the outside covering of flattened cells (ectoderm), and the inner layers of round yolk cells (entoderm). The entoderm then grows on all sides, and becomes thinner. The flattening-out of the ectoderm is evidently a rather complicated process, which Lieberkühn tries to elucidate, following Balfour (*Comp. embryol.*, ii. 181, 182). Next appears the mesoderm, before the primitive streak becomes visible. The cells of the middle layer appear between the two primitive layers, at first at the posterior end of the disk. They are certainly derived in part from the ectoderm, and very probably in part also from the entoderm, since in the region of the primitive streak the three layers are not limited one from another. Yet at first the mesoderm appears in the mole as a simple layer of cells between ento- and ectoderm. The primitive streak is a thickening of the mesoderm, and terminates anteriorly in a special thickening known as the cephalic process. This appears in guinea-pigs on the thirteenth day. The mesoderm in the process is entirely separated from the ectoderm, which rises in a slight convexity over it. The passage of the adherent (mesodermic) primitive streak to the free 'process' is known as Hensen's knot, it being marked later by a slight enlargement. The process grows forward; and at the time it reaches the dark edge of the disk a longitudinal canal appears in the midst of it, short at first, but rapidly elongating. The canal subsequently breaks through into the entoderm; the opening gradually, but irregularly, extends the length of the canal, which thus becomes, as it were, a trough or furrow in the dorsal wall of the entoderm. The cells of the canal are cylindrical and high; the furrow flattens out, and its wall then appears a constituent part of the entoderm. This stage has been seen by previous observers. By the time the canal is opened about to the middle of the germinal disk, the formation of the medullary groove begins. In the next stage Hensen's knot is relatively nearer the posterior end of the disk. The protovertebrae appear. By the time there are four, the chordal canal continues to grow backward in the primitive streak in the same manner as at first; but at the posterior end the differentiation of the chorda no longer precedes, but follows, that of the medulla and intestine. The manner in which the notochord becomes finally separated from the entoderm has been accurately described in other publications. (The author's text and plates are arranged in inexcusable confusion. Those who wish to read the original are counselled to begin with a careful study of the explanation of the plates.) — (*Arch. anat. physiol.; anat. abth.*, 1882, 399.) C. S. M. [399

Foetal envelopes of Chiroptera. — According to Robin, the foetal envelopes of the Phyllostomidae resemble rather those of the rodents than of other Chiroptera. — (*Comptes rendus*, Dec. 26, 1882.) C. S. M. [400

The evolution of deer-antlers, and atavism in the hog-deer. — A pair of antlers of the hog-deer (Axis porcinus) is described by J. Cockburn, in which the left horn bears five tines. The first two are normal; the third is bent inward and backward; the fourth and fifth correspond somewhat closely to the 'royal' and 'sur-royal' of the Wapiti (Alces canadensis). Caton's opinion that such unusual forms are due to accident is not concurred in, the present and other similar cases being explained by atavism.

Garrod's law, according to which the typical antler consists of a bifurcated beam, with a brow-antler near the base, is set aside in favor of Dawkin's theorem, which is recast in the following words: "The development of the antlers of individual species of cervines is a recapitulation of the history of the development of antlers in the group." The typical or primeval antler, according to Cockburn, is a simple spike, "capable of extensive furcation, reduplication, arrest and redundancy of growth in parts." An attempt is made to explain the form of the antlers of various species of deer according to this theory. — (*Journ. Asiat. soc. Bengal*, li., 1882, 44.) F. W. T. [401

Behavior of the American flying-squirrel in confinement. — Mr. F. H. King, who kept three young flying-squirrels (*Sciuropterus volucella*) in confinement for several months, gives an interesting account of their actions. They were strictly nocturnal, assuming an especially playful mood at 10.45 P.M. and 3.30 A.M., which, in each case, lasted an hour or more. When on the wing, and just prior to alighting, the fore-limbs were made to vibrate as if in true flight. One of the specimens, having broken a hind-leg,

strongly objected to the splints which were applied, and cut them loose at once; but soon after, it submitted to the treatment a second time with grace, and made no effort to free himself. Nuts were the favorite food; but animal food was not always rejected. Acorns, when first offered, aroused remarkable emotion, and an effort was made to bury them. After they were added to the *menu*, all other nuts were rejected, except hazelnuts. The squirrels, when taken, were too young to have had any experience in storing nuts. The chief pet did not fail to recognize Mr. King after an absence of three months. — (*Amer. nat.*, 1883, 36.) F. W. T. [402

Taxonomy of the hoofed quadrupeds. — E. D. Cope, taking cognizance of both living and extinct forms, emphasizes the taxonomic value of the arrangement of the carpal and tarsal bones. He recognizes the following orders and suborders: Taxeopoda, including suborders Hyracoidea and Condylarthra; Proboscidea, including suborders Proboscidea and (probably) Toxodontia; Amblypoda, including suborders Pantodonta and Dinocerata; and Diplarthra (equals Ungulata of most writers), including suborders Perissodactyla and Artiodactyla. The forms in which the two rows of carpal and tarsal bones do not alternate are mostly extinct, while those in which they do alternate have endured. The Perissodactyla and Artiodactyla, as well as the Proboscidea, are regarded as descendants of the Taxeopoda, representing different branches of that order. — (*Proc. Amer. philos. soc.*, xx., 1882, 238.) F. W. T. [403

A mole pursues an earthworm to the surface of the ground, and drags it below (F. Lang). — (*Zoölogist* (3), vii. 76.) F. W. T. [404

ANTHROPOLOGY.

Michlucho Maclay's travels. — Our readers will recall the charming letters we used to read a year or two ago from this distinguished traveller, and will be pleased to learn that he has resumed the publication of his researches by a series of lectures before the Russian geographical society. He has brought home from New Guinea and the Malacca peninsula both objects and drawings illustrative of the person, dress, implements, dwellings, activities, social life, and religion of the natives.

The natives of the north-west coast are at the lowest stage of culture. Before Mr. Maclay's visit, they used only implements of stone, bone, and wood, and knew not how to make fire. They do not bury their dead, but place the corpse in a sitting position, and, having covered it with palm-leaves, dry it by means of fires. There is but one race of Papuans, those of the interior belonging to the same race as those of the coast. Both dolichocephalic and brachycephalic crania have their representatives among the purest Papuans of the Malay coast; the transversal diameter of the Papuan skulls varies from 62 to 86 per cent of the length. The clustered hair often insisted on by many writers does not exist among Papuans, not even among children. Furthermore, the size of the curls is no criterion of distinction between the Papuans and Negritos. The method of race mixture is very well explained in the traffic in girls carried on between Celebes and New Guinea. At Port Maresby (Anapuata) on the southern coast, a mixture of Polynesian blood among the Papuans was noticed. These Metis have a lighter skin and uncurled hair, and practise tattooing. The women tattoo themselves from the forehead to the feet, and often shave the head to tattoo it. The men are marked only to exhibit some of their exploits. Mr. Maclay made five visits to New Guinea, and the full account of his work will be eagerly looked for.

In a subsequent communication Mr. Maclay reported his extended travels, full of most valuable information, in the Malay peninsula, and among the islands of Malaysia, Micronesia, and Melanesia, as well as in Australia. — (*Nature*, Dec. 7, 21.) [405

Documentary history of New York. — Those who have had occasion to study the Indians of eastern United States during the colonial period will recall the invaluable help they received from the ten ponderous volumes of the Documentary history of New York, compiled by Mr. O'Callahan. It is not to these that we wish to recall attention, but to the thirteenth volume of the series, just received, containing documents relating to the history and settlements of the towns along the Hudson and Mohawk rivers, from 1630 to 1684, and also illustrating the relations of the settlers with the Indians, translated and edited by B. Fernow, keeper of the historical records. The work is prefaced by a letter from Joseph B. Carr, secretary of state, and concludes with an appendix by Dr. J. G. Shea, being an extract from the narrative of the captivity of Father Isaac Jaques, among the Mohawks in 1642 and 1643. A complete table of contents and a good index leave nothing to be desired in the way of perfecting the volume. — J. W. P. [406

Urgent need in anthropology. — Mr. William L. Distant writes to *Nature*, that, while zoölogy and geology have each a yearly 'record,' anthropology still remains without that aid to its proper advancement. The bibliographies of the German publications, and of Prof. O. T. Mason in the *Naturalist*, are referred to. It would be well for those interested in such matters, while waiting for a more systematic annual test, to keep a close lookout for the *Revue d'anthropologie*, the more extended bibliography of American anthropology by Mr. Mason, in the Smithsonian Annual Report, and especially for the *Index medicus*, published in Washington. In the last-named periodical, under the words, 'biology,' 'physiology,' 'craniology,' and 'anthropology,' will be found the titles of almost all the best productions upon anthropology. — (*Nature*, Nov. 30, 1882.) J. W. P. [407

Cannibalism in New England. — Mr. Henry W. Haynes has discovered evidences of this horrid custom on the coast of Maine. The shell-heaps of Mount Desert and vicinity yield the evidence; and the people who practised the eating of their fellow-mortals were the ancient aborigines. The author cites other writers as witnesses to the fact. — (*Proc. Boston soc. nat. hist.*, xxii.) [408

EARLY INSTITUTIONS.

Universities. — In a rectorial address to the students at Aberdeen, Alexander Bain describes the history of universities and the university ideal. It is interesting to read this in connection with the address of Dr. Behrend at Greifswald, in the *Deutsche rundschau* of last December. — (*Pop. sc. monthly*, Feb., 1883.) D. W. R. [409

The early Germans. — R. Schröder sums up the conclusions of Louis Erhardt, *Aelteste germanische staatenbildung* (Leipzig, 1879), as follows: 1°, Germanic origin of the Nervii, Treviri, and other Belgic peoples; 2°, many small kingdoms (*pagi*) among the Germans; 3°, each kingdom governed by a king and senate of a hundred members (*centeni ex plebe comites*); 4°, the *pagi* of Caesar and Tacitus must not be confounded with the later hundreds. — (*Hist. zeitschr.*, 6 heft, 1882.) D. W. R. [410

Statistics of population. — Dr. H. Paasche writes regarding the population of the cities of western Europe during the middle ages, that, even as late as the seventeenth century, no regular estimates of population were made. Nobody cared for statistics of this sort: consequently there is a gap in our knowledge of economic and social life of those times, which can only be filled up by reasoning from incidental items in town and city records. The writer takes up the history of Rostock in the fifteenth and sixteenth centuries, and shows how this may be done. — (*Jahrb. nat.-ökon. statist.*, Nov. 15, 1882.) D. W. R. [411

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Coast and geodetic survey.

Recent deep-sea soundings of unusual depth. — In the prosecution of recent deep-sea soundings off the West-Indian islands by the U. S. steamer 'Blake' (Lieut.-Comdr. W. H. Brownson, U.S.N., commanding), for the purpose of ascertaining the extent of the continental plateau and the border of the oceanic basin, some extraordinary depths have been reached, and successfully measured by the method of wire-sounding; the specimen-cup and thermometers having been brought up from depths exceeding five miles.

The following extracts from the report of Lieut.-Comdr. Brownson, addressed to Prof. J. E. Hilgard, superintendent of the survey, will be of general public interest. It is written from St. Thomas, under date of Jan. 29, 1883.

"I enclose, herewith, approximate positions of soundings taken on lines, first, from Mariguana to Ocean plateau, thence down through Turks island passage to coast of Hayti, — second line from Samana promontory to Navidad bank, — and thence out to Ocean plateau. . . . From an inspection of the chart to the northward of this island, in connection with the result obtained by me on last line, and the soundings taken by Sir George Nares in the 'Challenger,' I thought it more than probable that the deep water found by him (3,875 fathoms) would extend to the westward. . . .

"On the 27th inst., in lat. 19° 40′ 50″, long. 66° 23′ 40″, seventy-one miles west of 'Challenger's' greatest depth, with long rolling sea, fresh trade-winds, with frequent squalls of wind and rain, sounded in 4,561 fathoms. In reeling in, cross-heads of sounding-machine showed great strain on wire: so shipped cranks to assist reeling-engine over the centre to prevent sudden strain on wire; and, by using every care to ease the strain, we succeeded in recovering the sounding-rod and thermometer. The bottom was brown ooze; temperature 36¼° F.

"Fifteen and a half miles south-east of the latter station sounded again in 4,223 fathoms, bottom of two layers of ooze, brown on top, with under-strata of gray; temperature 36°. When the wire was nearly in, the reel showed signs of being crushed, cracking in several places; but fortunately it did not give way. With the last sounding, two bottom-thermometers were sent down, — a Miller Casella No. 49,406, and a Tagliabue No. 531. The latter came up crushed by the excessive pressure. The reading of the Miller Casella I have no reason to doubt.

"I doubt if the sounding machine and wire has ever before successfully withstood so great a strain.

"In the soundings taken by Capt. Belknap in the Pacific, in no case that I can find were the sounding-rod and bottom-thermometer recovered in over 4,356 fathoms.

"In the second sounding, the wind had freshened considerably, and there was a short ugly sea in addition to the long swell."

Geological survey.

The Grand Cañon Group. — Marble Cañon and the Grand Cañon constitute together a continuous gorge, through which the Colorado river courses for 250 miles. The walls of the gorge are not sheer precipices, but are terraced on a grand scale; the succession of platforms and cliffs being determined by the succession of strata, which, for the most part, lie horizontal. The top of the wall is everywhere upper carboniferous; and thence downward for about 4,000 feet there is a nearly uniform system of paleozoic rocks, conformable in dip. The principal member of this conformable series is so massive that the cliff formed by it is unscalable at nearly all points; so that almost the only access to the depths of the gorge has been by boats. In Major Powell's first exploration of the Colorado, he discovered at the head of the Grand Cañon, where the gorge is deepest, a system of inclined rocks which had been greatly eroded before the deposition of the conformable series. These unconformable rocks, which he named the *Grand Cañon Group*, rest in turn upon schistose and granitoid rocks having the general facies of the archean. The difficulties of the voyage, and especially the exhaustion of supplies, rendered it impossible for him to make extended search for fossils; and, in lack of paleontologic evidence, he assigned the Grand Cañon Group provisionally to the Silurian, and referred the whole of the conforming series above it to the carboniferous. Mr. Gilbert, examining soon after the section at the lower end of the gorge, discovered no unconformity, except that between the metamorphic and non-metamorphic rocks; and, finding Cruziana in the lowest member of the unaltered rocks, he referred it provisionally to the lower Silurian. He named this member the *Tonto Group*. Still later Mr. C. D. Walcott, making a careful study of the section at an intermediate point, discovered an unconformity by erosion above the Tonto, and at the same time obtained additional fossils which served definitely to place the Tonto in the Cambrian. The question then arose, whether the unconformity by erosion, observed by Walcott, was the equivalent of the unconformity by dip observed by Powell. If it was, then in Powell's section the Tonto lay immediately above the archean, and the Grand Cañon Group was Cambrian. If it was not, then the Tonto was to be found at the base of Powell's conforming series, and the Grand Cañon Group was Pre-Cambrian. For the sake of settling this question, and at the same time of exploring the Pre-Cambrian rocks, if such they should prove to be, Major Powell, last autumn, made an excursion to the locality, with great difficulty constructing a horse-trail from the upper plateau to the brink of the river, where the rocks are best exposed. He found the Tonto at the base of the upper series, and thus demonstrated the Pre-Cambrian age of the Grand Cañon Group. The rocks being unmetamorphosed, and the series having a thickness of more than ten thousand feet, there is great reason to hope that they will prove fossiliferous, and thus add a prefatory chapter to the

geological record. Mr. Walcott, who accompanied Major Powell, remained on the ground to search for fossils, and has not yet completed his examination. If he discovers them, his report will be eagerly received alike by geologists and biologists.

NOTES AND NEWS.

—Professor Felipe Poey of Havana, under date of the 24th of January, 1883, announces that the Spanish government has purchased his *Ichthyologia cubana* for $4,000. It will be exhibited in the exposition in Amsterdam. He hopes to have it printed in Madrid. The work is in ten volumes, each 4¼ by 3½ decimetres. They contain 1,040 plates of fishes of every period of growth. The drawings were made by himself from the life. Many of the plates occupy three, and even six, double pages. About half fill only one single page each.

The plates represent 758 species of Cuban fishes (1,300 individuals), 90 scales, 94 vertical sections, 87 entire skeletons, 51 half-skeletons, 43 details of skeletons, 85 complete visceras, 32 details of visceras, 8 entozoa, 120 miscellanea.

—The addresses at the memorial meeting last October in honor of the late Prof. W. B. Rogers, the founder of the Massachusetts institute of technology, have been appropriately published by the Society of arts of the institute in a separate pamphlet. An excellent portrait, apparently from a photograph taken about five years ago, reproduced in heliotypy, accompanies the pamphlet. The addresses were of unusual interest, and well illustrate the breadth and catholicity of Professor Rogers's life. Perhaps the most interesting to the Boston audience were the remarks, toward the close of the meeting, by Major Hotchkiss of Virginia, who spoke of his earlier life in the South. We quote the following passage:—

"All over the state of Virginia, even now, you will continually meet people in the country—old men and old women—who recollect the days when Professor Rogers drove up with his gig, with Levi, his negro servant, behind him on horseback, accompanying him in his geological rambles—recollect with pleasure that familiar lecture in the morning from the doorstep; for he never went away without leaving with each one that he visited a new vision of that which before they had seen with sealed eyes, that it was his delight to unseal. One of the best of our living structural geologists, one of that same Scotch-Irish race, when a flaxen-haired boy, heard Professor Rogers describe to a group of listeners one of the grand arches of one of Virginia's mountain ranges, when, stooping down, like another great teacher, he wrote its structure in the sand, but wrote for all time. . . .

"It would furnish material for a singular study,—that primal geological circle. Levi, the negro serving-man, was in it. He became a geologist. He learned to think as his master thought. And when the great French geologist, Daubeny, came to visit Professor Rogers . . . Levi drove him; and, as they rode through the grand sections of Appalachian structure there displayed, Levi gave him lessons in American geology. 'Dis, sar,' said he, 'we call number one. Mighty fine *crap* (out-crop) ob it 'long here.' He had so well learned the lesson from the great master of American geology, he could teach it to the one of French."

—The international geological congress at Bologna in 1881 appointed a commission to prepare a map of Europe, and the following particulars have now been agreed upon: the topographic basis will be prepared by Kiepert, and published by Reimer & Co. at Berlin, but with French wording. It will consist of 49 sheets on a scale of 1:1,500,000, the whole measuring 3.72 by 3.36 metres. Mountain shading will be omitted. 900 copies have been engaged by various governments, and thus the price has been brought down to the reasonable figure of 100 francs. Although some six years will be needed for its completion, those who wish copies are requested to subscribe at once.

—The Archaeological institute of America now numbers about 80 life, and 220 annual members, and, besides its Reports and its Papers (of two series), has commenced the publication of a Bulletin, the first number of which gives a statement by the executive committee of the work of the institute in 1882, as far as regards the undertakings at Assos; a report by Mr. Bandelier on his investigations in New Mexico in the same year; and a note by Mr. Ludlow on a terra-cotta figurine of a centaur from Cyprus, interesting as having human fore-legs like those found in the sculpturings of the epistyle of the temple at Assos by the expedition of the institute. Mr. Diller, we learn from the committee's report, spent the greater part of his vacation last year in continuing his studies of the geology of the Troad.

The paper by Mr. Bandelier is the longest, the most important, and of the largest interest to scientific readers. He reaches the conclusion that the present condition of the Pueblo Indians is not their original one, but has been largely affected by contact with the whites, and that there were only two types of aboriginal architecture in New Mexico,—"the many-storied communal house, and the one-story building of stone." He contrasts, also, the 'cacique' of to-day and that of the old Spanish authors.

Interest in the work of the institute will be increased by the timelier publication of results which the establishment of the Bulletin will permit.

—The Cincinnati society of natural history celebrated the birthday of Charles Darwin on Feb. 23. Prof. A. G. Wetherby delivered an address on the Influence of Darwinism upon science, which was followed by an exhibition of microscopes. The reception had to be postponed from the 12th, owing to the flood in the Ohio, and the consequent stoppage of the gas-works.

—In the article The glacial theory before the Philadelphia academy (SCIENCE, p. 97), the statement occurs that "the greatest snow-clad elevation in Greenland is Washington Land." The author wishes this changed to "the greatest snow-clad elevation *in the region of greatest cold* (the west) in Greenland," etc.

PUBLISHER'S DEPARTMENT.

PUBLISHER'S NOTES.

THE first successful type-writer was that now so skilfully made by the Remingtons. Just as it was the first to succeed, so it has been the most active in making improvements, so as to maintain the popular favor which it gained. Indeed, it has become so popular, that the general agents for America, Messrs. S , Benedict, & Seamans, of 281 Broadway, New-York City, have on hand a greater number of orders than they can fill in the next three months. And even now they constantly receive orders, although the Remington type-writer advertisements are withdrawn for the present.

RARE GEMS AND MINERALS. — W. J. Knowlton, Mineralogist, 168 Tremont Street, Boston. Persons desiring fine gems will be repaid for examining my stock.

ANCHOR LINE. — The steamers of the Anchor Line sail from New York to Glasgow, Saturday, carrying the United-States mails; from New York to Barrow-in-Furness and to Avonmouth (Bristol), at regular intervals. Drafts issued (payable free of charge) on Great Britain and Ireland at lowest rates. For freight, passage, and all other information, apply to Henderson Brothers, 7 Bowling Green, New York, and 7 and 9 State Street, Boston.

BACK NUMBERS MAGAZINES, reviews, books published in parts, out-of-print books, books in foreign languages (Oriental, etc.), odd and out-of-the-way books, books that have been searched for without success. Pamphlets, reports, medical journals, both American and foreign. Second-hand school-books, scarce theological books and pamphlets, bought, sold, and exchanged. Pick-up orders solicited. A. S. Clark, 21 Barclay Street, New York.

THE HARVARD BOOK. — A set (two volumes) of this magnificent work, bound in full morocco, with its hundred and twenty-five quarto-photographs, can be had of Charles W. Sever, University Bookstore, Cambridge, Mass.

THE JOURNAL OF EDUCATION (the National and New England). National in spirit and character. Devoted to the departments of the Kindergarten, the Primary Schools, the Grammar Schools, the High Schools and Colleges, with able home and foreign correspondents. The various departments contain contributions from the best writers and educators. Just the paper needed by teachers of every grade, and recommended by the highest authorities in the country. Its departments cover every part of educational work. Weekly: Price $3.00 per year; in advance, $2.50. Thomas W. Bicknell, publisher, 16 Hawley Street, Boston.

THE PRIMARY TEACHER is devoted solely to the interests of Primary and Kindergarten instruction in America, and is unrivalled in its sphere. It is the best extant guide on *methods* of elementary instruction for inexperienced teachers. It largely takes the place of a normal course of training for this grade of educators. William E. Sheldon, editor. Monthly, $1.00 per year. Thomas W. Bicknell, publisher, Boston.

THE CALIGRAPH is the latest and best writing-machine. Its actual portability, great simplicity, and moderate cost, commend it to all classes of writers, while the variety and beauty of its type meet all tastes. It is on sale, and copying is done upon it, at the New-England office, Beale & Belcher, general agents, 36 Bromfield Street, Room 1, Boston, Mass.

J. B. HAMBLIN, No. 5 Bromfield Street, near Washington Street, Boston, Mass., is a practical optician, and does fine watch-repairing by practical watchmakers.

D. P. ILSLEY & CO.

THE LEADING HATTERS AND FURRIERS.

D. P. Ilsley & Co. are probably the most enterprising and most successful hat, cap, and fur house in Boston; and their establishment, at No. 381 Washington Street, directly opposite the head of Franklin Street, is one of the largest and most magnificent. The senior member of the firm has been engaged in the same business in Boston for upwards of thirty consecutive years; and from the first his ambition has led him to strive for the prominent position which he attained years ago, and well maintains to-day. That he has fully deserved his success no one will question who knows how devoted he has been to the study of his business, how attentive he has been to his patrons' wishes, how honorable have been all his transactions, how generously his business is conducted, how complete his stock is at all times, how attractively his establishment is kept, and how well satisfied his host of customers are. Mr. Ilsley's stock includes straw, felt, fur, and other varieties of hats for ladies, gentlemen, and children; furs of all good grades; umbrellas, canes, etc. These goods are from the leading makers of Europe and America. Many of the styles are from designs by Mr. Ilsley, who is ever on the alert for something unique and beautiful. A good part of his stock is the result of his own selections in foreign markets. Mr. Ilsley has quietly, yet noteworthily, devoted a part of his establishment to the making of hats for ladies; constantly introducing the best goods and the loveliest styles of hats and trimmings. It is perfectly safe to say, that no similar establishment in New England has a more distinguished patronage.

SCIENTIFIC NOTES.

ANATOMICAL TECHNOLOGY AS APPLIED TO THE DOMESTIC CAT. — Octavo. 600 pages. 130 figures. 4 lithograph plates. Price $4.50. "Contains the best collection of practical descriptions of the manner of preparing bones, preserving soft parts, making injections, etc., with which we are acquainted. The directions for studying the anatomy of the cat are explicit and well-arranged. . . . Bears the marks of prolonged personal experience, which has secured uncommon accuracy." — *The Nation*, Jan. 25, 1883. Published by A. S. Barnes & Co., New York.

WILLIAMS & EVERETT of Boston, the oldest and most prominent art and picture-framing establishment in New England, keep an extensive stock of photographs and carbon-pictures of eminent persons, noted places, and famous paintings. In their gallery they are constantly offering fresh attractions, directly from the studios of leading foreign and American artists, in oil and water colors. Their folios, too, are always full of rare proofs and excellent prints of fine engravings, etchings, etc. And in the way of artistic framing, no concern surpasses the work executed by Williams & Everett of Boston.

USERS of chemical glassware, anatomical and specimen jars and phials, glass tubing, and other similar requisites for museums and laboratories, should remember that the old New-England Glass-Works of Boston and Cambridge still maintain the reputation acquired during sixty years in the manufacture of such articles, of which they have always made a specialty. The proprietors, William L. Libbie & Son, Boston, solicit direct correspondence with institutions or individuals requiring any thing of this kind.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "Editor of SCIENCE, *Cambridge, Mass.*;" and all business correspondence to Moses King, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

readers. Large 8vo. 810 pages. Cloth. $5.

M'Clintock & Strong's Cyclopædia.

A Cyclopædia of Biblical, Theological, and Ecclesiastical Literature. By the late Rev. JOHN M'CLINTOCK, D.D., and JAMES STRONG, S.T.D. With maps and numerous illustrations. Complete in ten volumes. 8vo. Price per volume, cloth, $5; sheep, $6; half morocco, $8.

Abbott's Dictionary of Religious Knowledge.

A Dictionary of Religious Knowledge, for popular and professional use; comprising full information on biblical, theological, and ecclesiastical subjects. With nearly one thousand maps and illustrations. Edited by the Rev. LYMAN ABBOTT, with the co-operation of the Rev. T. J. CONANT, D.D. Royal 8vo, containing over 1,000 pages. Cloth, $6; sheep, $7; half morocco, $8.50.

Mahaffy's Greek Literature.

A History of Classical Greek Literature. By J. P. MAHAFFY. Two volumes. 12mo. Cloth. $4.

Simcox's Latin Literature.

A History of Latin Literature from Ennius to Boethius. By GEORGE AUGUSTUS SIMCOX, M.A., Fellow of Queen's College, Oxford. In two volumes. 12mo. Cloth. $4.

Anthon's Classical Dictionary.

Containing an account of the principal proper names mentioned in ancient authors, and intended to elucidate all the important points connected with the geography, history, biography, mythology, and fine arts of the Greek and Romans, together with an account of the coins, weights, and measures, with tabular values of the same. Royal 8vo. Sheep. $4 25.

Lossing's Cyclopædia of United States History.

Harper's Popular Cyclopædia of United States History. From the Aboriginal period to 1876. Containing brief sketches of important events and conspicuous actors. By BENSON J. LOSSING, LL.D. Illustrated by two steel-plate portraits and over a thousand engravings. Two volumes. Royal 8vo. Cloth. $12.

Crabb's English Synonymes.

English Synonymes explained in Alphabetical Order. With copious illustrations and examples drawn from the best writers; to which is now added an index to the words. By GEORGE CRABB, A.M. New edition, with additions and corrections. 12mo. 856 pages. Cloth. $2.50.

Political History of Recent Times (1816–1875).

With Special Reference to Germany. By WILHELM MÜLLER, Professor in Tübingen. Revised and enlarged by the author. Translated, with an appendix covering the period from 1876 to 1881, by the Rev. JOHN P. PETERS, Ph.D. 12mo. Cloth. $3.

Engineers' and Mechanics' Pocket-Book.

By CHARLES H. HASWELL, C. and M.E. Forty-first edition, revised and enlarged. 12mo. Pocket-book form. $3.

Anthon's Smith's Dictionary of Antiquities.

A Dictionary of Greek and Roman Antiquities. Edited by WILLIAM SMITH, LL D., and illustrated by numerous engravings on wood. Third American edition, carefully revised, and containing, also, numerous additional articles relative to the botany, mineralogy, and zoölogy of the ancients. By CHARLES ANTHON, LL.D. Royal 8vo. Sheep. $4.25.

☞ *Any of the above works sent by mail, postage prepaid, to any part of the United States on receipt of the price.*

THE PUBLISHER'S GREETING

TO THE

CONTRIBUTORS AND SUBSCRIBERS.

The following lists of contributors and subscribers are here printed in the hope of giving pleasure to the many contributors to SCIENCE *by showing them in detail the extensive and spontaneous reception which the public has awarded their efforts to establish a weekly scientific journal which should reflect creditably on Americans and American institutions, and then of giving permanent credit to the several hundred persons, who, by their prompt subscriptions, have shown their earnest good-will and sympathy with this laborious and responsible undertaking.*

The list of contributors will also show to subscribers that the projectors of the enterprise have exerted every effort to obtain from eminent authorities everywhere the news and articles which are appearing in the consecutive issues of SCIENCE.

It should be added, that other names ought to appear in the list of subscribers, — some because received too late, and others, who, by reason of absence or remote residence, and from other causes, have not yet had an opportunity of subscribing. And among the contributors might justly appear the names of many persons whose contributions the editors have accepted, and others who are actively engaged on articles soon to be published. In justice to both these classes, the publisher proposes later to issue a handsome volume containing names of all the contributors and subscribers, a copy of which will be sent to each one of them with the compliments of the publisher.

In looking over the successive numbers of SCIENCE, *one can readily see that a generous support has come from business men of numerous cities. The publisher trusts, therefore, that the readers of* SCIENCE *will always look through the advertising pages, and patronize these advertisers when possible; assuring them that he will make an investigation of any case where a patron seems to be unjustly treated, with a view of excluding that advertiser from future pages of* SCIENCE. *But there will probably be no difficulty; for the advertisers are, as a rule, well-known and thoroughly trustworthy firms; and in the volume above referred to there will be a classified list of advertisers in the earlier issues of* SCIENCE, *as being worthy of acknowledgment for their support.*

The publisher also desires to call particular attention to the fact that when SCIENCE *was projected, — notwithstanding it promised to be a pecuniary failure, — a company of scientific men and patrons of science was formed for its maintenance. To them, therefore, — although the enterprise now promises to become a pecuniary success, — is due all the credit for their philanthropic intentions. The directors of this Company are D. C. Gilman (president), the president of Johns Hopkins University; Alexander Graham Bell (vice-presi-*

dent), inventor of the Bell Telephone; Gardiner G. Hubbard; Othniel C. Marsh, professor at Yale College; Samuel H. Scudder (treasurer), president Boston Society of Natural History.

And to those who are and who may become subscribers, it may again be said that SCIENCE, *in its first two volumes, comprising one year, will furnish about fifteen hundred pages of text wholly apart from any kind of advertising, and will be provided with suitable titlepages and carefully-made indexes. It is the aim of The Science Company to publish such a periodical as will well be worth binding in permanent form, and one which will return for every subscription an ample* quid pro quo.

The annual subscription in the United States and Canadas is five dollars, and, in the countries of the International Postal Union, six dollars. Single copies, fifteen cents. No electrotype plates are made of the pages of text; and subscribers who fail regularly to receive their copies will please notify the publisher at once; for before long it will be impossible to supply back numbers.

FOR THE SCIENCE COMPANY,

MOSES KING, *Publisher*,

HARVARD SQUARE, CAMBRIDGE, MASS.

LIST OF CONTRIBUTORS.

INCLUDING ONLY THOSE WHOSE CONTRIBUTIONS HAVE ACTUALLY APPEARED IN THE FIRST SEVEN ISSUES OF "SCIENCE."

Dr. C. C. ABBOTT, Trenton, N.J.
Professor H. P. ARMSBY, Worcester, Mass.
Professor SPENCER F. BAIRD, Smithsonian Institution, Washington, D.C.
Professor GEORGE F. BARKER, University of Pennsylvania, Philadelphia, Penn.
Mr. H. W. BLAIR, Coast and Geodetic Survey Office, Washington, D.C.
Dr. WALTER K. BROOKS, Johns Hopkins University, Baltimore, Md.
Mr. EDWARD BURGESS, Natural History Society, Boston, Mass.
Professor F. W. CLARKE, University Cincinnati, Cincinnati, O.
Professor J. H. COMSTOCK, Cornell University, Ithaca, N.Y.
Mr. C. S. COOK, Dartmouth College, Hanover, N.H.
Dr. THOMAS CRAIG, Johns Hopkins University, Baltimore, Md.
Mr. W. O. CROSBY, Natural History Society, Boston, Mass.
Professor CHARLES R. CROSS, Massachusetts Institute of Technology, Boston, Mass.
Capt. WILLIAM H. DALL, United-States Coast Survey, Washington, D.C.
Mr. WILLIAM MORRIS DAVIS, Museum of Comparative Zoölogy, Cambridge, Mass.
Dr. J. W. DAWSON, McGill University, Montreal, Can.
Mr. CHARLES DEANE, Massachusetts Historical Society, Cambridge, Mass.
Dr. H. T. EDDY, University of Cincinnati, Cincinnati, O.
Mr. S. F. EMMONS, Geological Survey, Washington, D.C.
Dr. W. G. Farlow, Harvard University, Cambridge, Mass.
Professor WALTER FAXON, Museum Comparative Zoölogy, Cambridge, Mass.
Professor S. A. FORBES, State Entomologist, Normal, Ill.
Mrs. C. L. Franklin, Baltimore, Md.
Dr. F. FRANKLIN, Johns Hopkins University, Baltimore, Md.
Professor EDGAR FRISBY, United-States Naval Observatory, Washington, D.C.
Mr. HENRY GANNETT, United-States Geological Survey, Washington, D.C.
Professor J. W. Gibbs, New Haven, Conn.
Mr. G. K. GILBERT, United-States Geological Survey, Washington, D.C.
Dr. THEODORE GILL, Smithsonian Institution, Washington, D.C.
Mr. G. BROWN GOODE, Curator U. S. National Museum, Washington, D.C.
Dr. GEORGE L. GOODALE, Botanic Garden, Cambridge, Mass.
Professor ASA GRAY, Botanic Garden, Cambridge, Mass.
Dr. EDWIN H. HALL, Harvard University, Cambridge, Mass.
Dr. G. STANLEY HALL, Johns Hopkins University, Baltimore, Md.
Dr. C. S. HASTINGS, Johns Hopkins University, Baltimore, Md.
Major DAVID P. HEAP, United-States Engineers, Washington, D.C.
Mr. F. H. HERRICK, Burlington, Vt.
Dr. JOSEPH E. HILGARD, Supt. U. S. Coast and Geodetic Survey, Washington, D.C
Mr. GEORGE ANTHONY HILL, Cambridge, Mass.
Professor E. S. HOLDEN, University of Wisconsin, Madison, Wis.
Dr. THOMAS STERRY HUNT, Montreal, Can.
Mr. SAMUEL HUSTON, Richmond, O.
Professor ALPHEUS HYATT, Natural History Society, Boston, Mass.
Mr. J. AMORY JEFFRIES, Harvard Medical School, Boston, Mass.
Mr. J. S. KINGSLEY, Boston, Mass.
Dr. SAMUEL KNEELAND, New-York City, N.Y.
Professor S. P. LANGLEY, Alleghany, Penn.
Dr. JOSEPH LEIDY, University of Pennsylvania, Philadelphia, Penn.
Professor LEO LESQUEREUX, Columbus, O.
Dr. H. CARVILL LEWIS, Academy Natural Sciences, Philadelphia, Penn.

Dr. D. G. LYON, Harvard University, Cambridge, Mass.
Dr. CHARLES F. MABERY, Harvard University, Cambridge, Mass.
Professor JULES MARCOU, Cambridge, Mass.
Mr. J. B. MARCOU, Cambridge, Mass.
Dr. H. NEWELL MARTIN, Johns Hopkins University, Baltimore, Md.
Dr. CHARLES SEDGWICK MINOT, Harvard Medical School, Boston, Mass.
Mr. N. MURRAY, Johns Hopkins University, Baltimore, Md.
Dr. JOHN S. NEWBERRY, Columbia College, New York.
Dr. E. J. NOLAN, Academy Natural Sciences, Philadelphia, Penn.
Mr. S. L. PENFIELD, Yale College, New Haven, Conn.
Mr. CHARLES B. PENROSE, Philadelphia, Penn.
Mr. W. H. PICKERING, Massachusetts Institute of Technology, Boston, Mass.
Major J. W. POWELL, Director U. S. Geological Survey, Washington, D.C.
Mr. D. J. PRATT, Albany Institute, Albany, N.Y.
Mr. FREDERICK W. PUTNAM, Peabody Museum, Cambridge, Mass.
Professor IRA REMSEN, Johns Hopkins University, Baltimore, Md.
Professor ROBERT H. RICHARDS, Massachusetts Institute of Technology, Boston, Mass.
Dr. CHARLES V. RILEY, Entomologist to Dept. of Agriculture, Washington, D.C.
Professor MILES ROCK, United-States Naval Observatory, Washington, D.C.
Mr. DENMAN W. ROSS, Cambridge, Mass.
Dr. J. A. RYDER, United-States Fish Commission, Washington, D.C.
Mr. F. G. SCHAUPP, Brooklyn Entomological Society, Brooklyn, N.Y.
Dr. A. R. C. SELWYN, Director Geological Survey of Canada, Ottawa, Can.
Professor NATHANIEL S. SHALER, Harvard University, Cambridge, Mass.
Professor SIDNEY I. SMITH, Yale College, New Haven, Conn.
Professor FRANCIS H. STORER, Bussey Institution, Boston, Mass.
Professor DAVID P. TODD, Amherst College, Amherst, Mass.
Mr. WILLIAM TRELEASE, University of Wisconsin, Madison, Wis.
Professor JOHN TROWBRIDGE, Harvard University, Cambridge, Mass.
Mr. FREDERICK W. TRUE, United-States National Museum, Washington, D.C.
Mr. J. B. TYRRELL, Ottawa, Can.
Mr. WINSLOW UPTON, Army Signal Office, Washington, D.C.
Professor GEORGE L. VOSE, Massachusetts Institute of Technology, Boston, Mass.
Dr. M. E. WADSWORTH, Museum Comparative Zoölogy, Cambridge, Mass.
Dr. LEONARD WALDO, Yale College Observatory, New Haven, Conn.
Mr. LESTER F. WARD, United-States National Museum, Washington, D.C.
Professor R. B. WARDER, Ohio Mechanics Institute, Cincinnati, O.
Mr. SERENO WATSON, Botanic Garden, Cambridge, Mass.
Mr. ALBERT WILLIAMS, Jun., United-States Geological Survey, Washington, D.C
Professor CHARLES A. YOUNG, College of New Jersey, Princeton, N.J.

LIST OF SUBSCRIBERS.

MASSACHUSETTS.

Boston.

Oliver Wendell Holmes	Poet and Professor.
Robert Charles Winthrop	Orator, Author, and Statesman.
George Edward Ellis	Historian.
Elizur Wright	Mathematician and Author.
Charles James Sprague	Poet, Lecturer, and Author.
John D. Runkle	Ex-President Institute of Technology.
Thomas G. Appleton	Author and Capitalist.
Charles F. Choate	President Old Colony Railroad.
William H. Baldwin	Pres. Young Men's Christian Union.
Benjamin F. Stevens	Pres. New-England Mutual Life-Ins.Co.
William P. Hunt	President South Boston Iron-Works.
William L. Libbey	President New-England Glass-Works.
Franklin Haven	President Merchants' National Bank.
John Cummings	President Shawmut National Bank.
W. W. Kimball	President Fourth National Bank.
Chester Guild	Pres. Manufacturers' National Bank.
William Endicott, jun.	President New-England Trust Co.
Henry P. Kidder	Kidder, Peabody, & Co.
Nathaniel Thayer	Capitalist.
Spencer W. Richardson	Richardson, Hill, & Co.
William H. Hill, jun.	Richardson, Hill, & Co.
Edward W. Hooper	Treasurer Harvard University.
Thomas T. Bouvé	Treasurer Glendon Iron Co.
Elisha S. Converse	Treasurer Boston Rubber-Shoe Co.
Edmund Dwight	Treasurer Boston Manufacturing Co.
Alfred P. Rockwell	Treasurer Great-Falls Manuf. Co.
Francis A. Osborn	Treasurer Corbin Banking Co.
E. P. Cutler	Treasurer Tremont Foundry Co.
H. Weld Fuller	Treasurer Woodlawn Cemetery.
Edward P. Bond	Man. Boston Safe Deposit and Trust Co.
Wallis S. Chase	Asst. Cashier Nat'l Bank of Commerce.
Charles C. Smith	Secretary Boston Gaslight Co.
Mellen Chamberlain	Librarian Boston Public Library.
Charles B. Tillinghast	Librarian State Library.
Charles A. Cutter	Librarian Boston Athenæum.
Melvil Dui	Library and Metric Bureaus.
Charles W. Parker	Macullar, Parker, & Co.
Nathan D. Robinson	Macullar, Parker, & Co.
James L. Wesson	Macullar, Parker, & Co.
John W. Wolcott	Proprietor Hotel Vendome.
W. Tracy Eustis	Financier Hotel Vendome.
John W. Dunklee	Proprietor Hotel Brunswick.
Henry B. Rice	Proprietor American House.
Royal M. Pulsifer	Proprietor Boston Herald.
Edward P. Call	Publisher Boston Advertiser.
Charles W. Ernst	Editor Boston Advertiser.
Edwin M. Bacon	Editor Boston Advertiser.
Edward H. Clement	Editor Boston Transcript.
Bradford K. Peirce	Editor Zion's Herald.
Samuel J. Barrows	Editor Christian Register.
William J. Rolfe	Editor Journal of Chemistry.
Henry D. Dupee	Walpole Dye and Chemical Works.
George L. Damon	Safe Maufacturer.
Charles Henry Wise	Gen. Agt. Chicago & North-west'n R.R
Edward A. Taft	General Manager New-York and Boston Despatch Express Co.
John Cotton Paige	Paige's Insurance Agency.
William R. Gray	Paige's Insurance Agency.
Sidney M. Hedges	Gen. Agt. Mutual Benefit Life-Ins. Co
James B. Niver	Agent Equitable Life-Insurance Co.
Edward J. Smith	General Agent North-western Mutual Life-Insurance Co.
Henry McL. Harding	Insurance Agent.
Samuel W. Winslow	Real-Estate Dealer.
Alexander S. Porter	Real-Estate Broker.
James Freeman Clarke	Pastor Church of Disciples.
Joseph Cook	Clergyman and Lecturer.
Robert C. Waterston	Unitarian Clergyman.
Samuel H. Winkley	Clergyman.
William Burnet Wright	Pastor Berkeley-street Church.
Minot J. Savage	Pastor Church of the Unity.
A. A. Miner	Pastor Columbus-avenue Universalist Church.
Caleb Davis Bradlee	Pastor Harrison-sq. Unitarian Church.
Samuel K. Lothrop	Pastor Brattle-square Church.
Henry W. Foote	Pastor King's Chapel.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month.

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news. One Dollar a year.

BOSTON DAILY ADVERTISER. The representative paper of New England. One Dollar a month

BOSTON WEEKLY ADVERTISER. One Dollar a year. All New-England news One Dollar a year.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "Editor of SCIENCE, *Cambridge, Mass.*;" and all business correspondence to Moses King, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

Skeat's Etymological Dictionary.

A Concise Etymological Dictionary of the English Language. By the Rev. WALTER W. SKEAT, M.A., Professor of Anglo-Saxon in the University of Cambridge. 12mo. Cloth. $1.25. Uniform with "The Student's Series."

M'Clintock & Strong's Cyclopædia.

A Cyclopædia of Biblical, Theological, and Ecclesiastical Literature. By the late Rev. JOHN M'CLINTOCK, D.D., and JAMES STRONG, S.T.D. With maps and numerous illustrations. Complete in ten volumes. 8vo. Price per volume, cloth, $5; sheep, $6; half morocco, $8.

Abbott's Dictionary of Religious Knowledge.

A Dictionary of Religious Knowledge, for popular and professional use; comprising full information on biblical, theological, and ecclesiastical subjects. With nearly one thousand maps and illustrations. Edited by the Rev. LYMAN ABBOTT, with the co-operation of the Rev. T. J. CONANT, D.D. Royal 8vo, containing over 1,000 pages. Cloth, $6; sheep, $7; half morocco, $8.50.

Mahaffy's Greek Literature.

A History of Classical Greek Literature. By J. P. MAHAFFY. Two volumes. 12mo. Cloth. $4.

Simcox's Latin Literature.

A History of Latin Literature from Ennius to Boethius. By GEORGE AUGUSTUS SIMCOX, M.A., Fellow of Queen's College, Oxford. In two volumes. 12mo. Cloth. $4.

Anthon's Classical Dictionary.

Containing an account of the principal proper names mentioned in ancient authors, and intended to elucidate all the important points connected with the geography, history, biography, mythology, and fine arts of the Greek and Romans, together with an account of the coins, weights, and measures, with tabular values of the same. Royal 8vo. Sheep. $4 25.

And Universal Information relating to all Ages and Nations. Seventeenth edition, containing the history of the world to the autumn of 1881. By BENJAMIN VINCENT, Librarian of the Royal Institution of Great Britain; Cor. Mem. Hist. Soc., New York. Revised for American readers. Large 8vo. 810 pages. Cloth. $6.

Lossing's Cyclopædia of United States History.

Harper's Popular Cyclopædia of United States History. From the Aboriginal period to 1876. Containing brief sketches of important events and conspicuous actors. By BENSON J. LOSSING, LL.D. Illustrated by two steel-plate portraits and over a thousand engravings. Two volumes. Royal 8vo. Cloth. $12.

Crabb's English Synonymes.

English Synonymes explained in Alphabetical Order. With copious illustrations and examples drawn from the best writers; to which is now added an index to the words. By GEORGE CRABB, A.M. New edition, with additions and corrections. 12mo. 856 pages. Cloth. $2.50.

Political History of Recent Times (1816–1875).

With Special Reference to Germany. By WILHELM MÜLLER, Professor in Tübingen. Revised and enlarged by the author. Translated, with an appendix covering the period from 1876 to 1881, by the Rev. JOHN P. PETERS, Ph.D. 12mo. Cloth. $3.

Engineers' and Mechanics' Pocket-Book.

By CHARLES H. HASWELL, C. and M.E. Forty-first edition, revised and enlarged. 12mo. Pocket-book form. $3.

Anthon's Smith's Dictionary of Antiquities.

A Dictionary of Greek and Roman Antiquities. Edited by WILLIAM SMITH, LL D., and illustrated by numerous engravings on wood. Third American edition, carefully revised, and containing, also, numerous additional articles relative to the botany, mineralogy, and zoölogy of the ancients. By CHARLES ANTHON, LL.D. Royal 8vo. Sheep. $4.25.

☞ *Any of the above works sent by mail, postage prepaid, to any part of the United States on receipt of the price.*

RHODE ISLAND.

Providence.

John Howard Appleton	Professor of Chemistry, Brown Univ.
Reuben A. Guild	Librarian Brown University.
Providence Athenæum.	
Homœopathic Library Association.	
Providence Public Library.	
Augustine Jones	Principal Friends' School.
William F. Channing	Physician.
George B Peck	Physician.
N. W. Littlefield	Lawyer.
Charles Bradley	Lawyer.
James Tillinghast	Lawyer.
Alfred Stone	Architect.
John F. Hedge, jun.	Electrician.
Edwin E Calder	Chemist.
James M. Southwick	Southwick & Jencks' Nat. Hist. Store.
Samuel Gorham	Huntoon & Gorham, Cigars.
Tibbitts, Shaw, & Co.	Booksellers and Stationers.
T. C Durfee	Grocer.
Theodore W. Phillips	Secretary Providence Steam-Engine Co.
Frank E. Seagrave	65 Westminster Street.
William Burney	72 Prospect Street.
N. B. Whitaker	305 Westminster Street.
Frank L. Titcomb	22 Nichols Street.
C. W. Vaughn	Consulting Chemist.
John R. Bartlett.	

Newport.

Raphael Pumpelly	Professor Engineer.
Joseph P. Cotton	Civil Engineer.
Theodore F. Jewell	Lieut. Commander U. S. N.

CONNECTICUT.

New Haven.

YALE COLLEGE.

	Professor Natural Philosophy.
	Professor Geology.
	Professor Sanskrit.
	Professor of Mining.
	Professor Mathematics.
	Professor Mineralogy.
	Professor of Agriculture.
	Professor Mathematical Physics.
	Professor Chemistry.
	Professor Paleontology.
	Professor Zoölogy.
	Professor Comparative Anatomy.
	Professor Chemistry.
	Astronomer.
	Professor Physiological Chemistry.
	Assistant in Zoölogy.
	Student Yale College.

School.

IN GENERAL.

Conn. Agricultural Experiment Station.	
Horace C Hovey	Pastor Second Congregational Church.
Thomas H. Pease & Son	Booksellers and Newsdealers.
William P. Blake.	
Edward E. Salisbury	Professor.

Hartford.

J. Hammond Trumbull	Philologist and Author.
Jacob L. Greene	Pres. Connecticut Mutual Life-Ins. Co.
J. M. Allen	President Steam-Boiler Inspection and Insurance Co.
James G. Batterson	President Travellers' Insurance Co.
G. Pierrepont Davis	Physician.
H. P. Stearns	Physician.
Charles P. Howard	Secretary, J. L. Howard & Co.

Berlin.

T. S. Brandegee.

Bridgeport.

James C. Lathrop.

Brooklyn.

S. A. Holman . . . . Physician.

Buckland.

Charles H. Owen.

Litchfield.

Miss Emma C. Jones.

Middletown.

John M. Van Vleck	Prof. of Mathematics, Wesleyan Univ.
William North Rice	Prof. of Geology, Wesleyan University.
W. Walter Webb.	

New Britain.

The American Electric Company.

Portland.

John H. Sage.

Riverside.

John Mulville.
William J. Selleck.

Stamford.

Yale Lock Manufacturing Co.
M. W. Sewall.

Waterbury.

Homer F. Bassett . . . . Librarian Bronson Library.

NEW YORK.

New-York City.

Frederick A. P. Barnard	President Columbia College
Charles F. Chandler	President Board of Health.
Charles F. Clark	President The Bradstreet Company.
Francis M. Weld	President Harvard Club.
John Osborne Sargent	Ex-President Harvard Club.
Lawson Valentine	President Valentine Varnish Company.
George T. Hope	Pres't Continental Fire-Insurance Co.
H. H. Lamport	Vice-Pres't Continental Fire-Ins. Co.
Louis Monrose	Monrose & Mulville.
John Mulville	Monrose & Mulville.
Henry P. DuBois	Monrose & Mulville Insurance Agency.
J. W. Selleck	Monrose & Mulville Insurance Agency.
Uriah Welch	Proprietor St. Nicholas Hotel.
Henry Edwards	Actor Wallack's Theatre.
Eugene G. Blackford	Fish-Dealer.
John H. Caswell	Importer of Teas.
Thomas W. Ward	Banker.
Thorndike D. Hodges	Lawyer.
Clinton Roosevelt	Lawyer.
Samuel L. M. Barlow	Lawyer.
Henry B. Hammond	Lawyer.
Thaddeus B. Wakeman	Lawyer.
John H Hinton	Physician.
Cornelius R. Agnew	Physician.
George T Stevens	Physician.
George H. Taylor	Physician.
Sidney H. Carney	Physician.
Louis Elsberg	Physician.
George M. Searle	Clergyman.
Ogden N. Rood	Prof. Mech. and Phys. Columbia Coll.
John S. Newberry	Professor Geology, School of Mines.
Nathaniel Hathaway	Chemist, School of Mines.
John K Rees	Director of Observatory.
Robert P. Whitfield	Curator American Museum Nat. Hist.
Daniel Draper	Meteorological Observatory.
Percy Neymann	Student Columbia School of Mines.
C. H. Leete	Dr. Sachs' Collegiate Institute.
Julius Sachs	Collegiate Institute.
John S. White	Principal Berkeley School.
Jonathan D Hyatt	Teacher.
Charles Nettleton	Commissioner and Notary.
Thomas A. Edison	Electrician.
Austin G. Day	Electric Wire and Supplies.
Leonard E. Curtis	Secretary U. S. Electric Lighting Co.
Cornelius Van Brunt	Machinery.
Frederick W. Devoe	Paints and Artists' Materials.
Samuel W. Simpson	Merchant.
E. B. Benjamin	Chemicals and Apparatus.
Henry B. Parsons	Chemist.
George F. Swain	Treasurer Valentine Varnish Company.
Charles S. Homer, jun.	Superintendent Valentine Varnish Co.
Lucius Pitkin	Chemist.
Nelson H. Darton	Analytic and Consulting Chemist.
D. D. Williamson	International Chemical Company
Stillwell & Gladding	Chemists.
George N. Lawrence	Drugs and Chemicals.
Ivison, Blakeman, Taylor, & Co.	Publishers.
John Wiley & Sons	Publishers and Importers
Henry Holt & Co.	Publishers.
John W. Lovell	Publisher.
D. Van Nostrand	Scientific Books.
Romyn Hitchcock	Editor and Microscopical Apparatus.
B. Westermann & Co.	Foreign Books.
J. W Bouton	Rare and Costly Books.
C. C. Hine	Insurance Editor and Publisher.
Samuel Kneeland	Author.
Henry M. Parkhurst	Stenographer.
Asa L. Shipman's Sons	Stationers and Manufacturers.
Albert Bierstadt	Artist.
A. R. Hart	Treasurer Photo-Engraving Company.
R. D. Servoss	Struthers, Servoss, & Co.
Carter, Sloan, & Co.	Manufacturing Jewellers.
Mercantile Library	Astor Place.
Astor Library	Lafayette Place.
Library of Columbia College	49th Street and Madison Avenue.
Anglo-Swiss Cond. Milk Co.	Of Switzerland.
University Club	No. 370 Fifth Avenue.
Mrs. Henry Draper	Madison Avenue.
Mrs. David C. Scudder	Grammercy Park.

Henry C. Andrews . . . . . 5 Beekman Street.
J. V. Cheney . . . . 14 East 25th Street.
F. B. Crocker . . . . 54 West 21st Street.
Charles F. Cox . . . . . . Banker.
Walter C. Hubbard . . . . . Cotton-merchant.
J. B. Taylor Hatfield . . . . 149 West 34th Street.
James Lloyd White . . . . 609 Fifth Avenue.
James T. Gardiner . . . . . 209 West 46th Street.
R. H. Lamborn . . . . . . Colorado Coal and Iron Company.
Albert S. Bickmore . . . . Supt. American Museum Natural Hist.
William Amory, jun. . . . . 48 West 39th Street.
N. A. Calkins . . . . 124 East 80th Street.

Brooklyn.

Alexander Hutchins . . . . Physician.
Elias Lewis, jun.
A. W. Humphreys.
Henry P. DuBois . . . . . Clerk, Monrose & Mulville.
A. R. Hart . . . . Photo-Engraving.
Frederick G. Schaupp . . . Teacher.
Henry H. Lamport.
S. A. Goldschmidt . . . . . Physician.
W. Le Conte Stevens . . . . Packer Institute.
The Brooklyn Library . . . Montague Street.
Marie O. Glover.

Albany.

State Museum of Natural History.
New-York State Library.
Albany Institute.
Dudley Observatory.
James Hall . . . . Geologist, State Museum of Nat. Hist.
Weare C. Little . . . . . . Law Publisher and Bookseller.
J. A. Lintner . . . . State Entomologist.
Samuel B. Ward . . . . . . Physician.
Moses G. Farmer.
Matthew Hale . . . . Lawyer.

Ithaca.

CORNELL UNIVERSITY.

Burt G. Wilder . . . . . . Professor of Physiology.
William A. Anthony . . . . Professor of Physics.
J. H. Comstock . . . . . . Professor of Entomology.
William R. Dudley . . . . Assistant Professor of Botany.
Henry Shaler Williams . . . Assistant Professor of Paleontology.
Simon H. Gage . . . . . . Professor of Physiology.
Cornell University Library.
H. P. Cushing.

Rochester.

H. R. Gilbert . . . . Book-keeper.
Lewis Swift . . . . Professor Warner Observatory.
Bausch & Lomb . . . . . . Optical Company.
Corlis B. Gardner . . . . . Clergyman.
Henry A. Ward . . . . . . Natural Science Establishment.
Cyrus F. Paine . . . . . . Druggist.
Edward H. Vredenburgh . . Cashier Banking-House.

Mountainville.

H. E. Alvord . . . . Houghton Farm.
H. F. Expt. Dept. . . . . . Houghton Farm.
Cyrus W. Shaw.
D. P. Penhallow.

Syracuse.

John J. Brown . . . . Professor Syracuse University.
George A. Edwards . . . . Physician.
Walter A. Brownell . . . . Professor High School.

Plattsburg.

D. S. Kellogg . . . . Physician.
George H. Hudson . . . . . Physician.

Poughkeepsie.

Miss Maria Mitchell . . . . Vassar College.
Le R. C. Cooley.

Buffalo.

W. H. Glenny . . . . Wholesale and Retail Crockery.
Asaph S. Bemis.

Clinton.

C. H. F. Peters . . . . Observatory of Hamilton College.
Albert H. Chester.

Newburgh.

John W. Doughty.
Haslett McKim . . . . . . Clergyman.

Troy.

Rensselaer Polytechnic Institute.
Charles E. Hansman . . . . Flour and Produce.

Alfred Centre.

H. C. Coon . . . . Physician.

Bangall.

Lewis Carman.

Cazenovia.

L. W. Ledyard.

Community.

George E. Cragin . . . . . Physician.

Dobb's Ferry.

R. Catlin . . . . Captain United-States Army.

Dunkirk.

H. Raymond Rogers . . . . Physician.

Geneva.

E. Lewis Sturtevant.

Gloversville.

O. K. Chamberlin . . . . . Physician.

Jamaica.

R. P. Stevens.

Long-Island City.

Anthony Pirz . . . . Professor.

Lowville.

W. Hudson Stephens.

Middletown.

Anglo-Swiss Condensed Milk Company.

Nyack.

George W. Hill.

Ogdensburg.

W. J. W. Finlay . . . . . Clergyman.

Oneida.

C. M. Ferry.

Oswego.

Henry H. Straight . . . . . Prof. Natural Science, Normal School.

Schenectady.

Morris Perkins . . . . Professor Union College.

Shelby.

J. D. Childs . . . . Clergyman.

Tarrytown.

Charles H. Rockwell.

Watertown.

J. M. Adams.

Willet's Point.

Henry L. Abbot . . . . . . Brigadier-General.

Yonkers.

E. O. Moore.

NEW JERSEY.

Princeton.

PRINCETON COLLEGE.

Arnold Guyot . . . . Professor of Geology.
J. Stillwell Schanck . . . . Professor of Chemistry.
Cyrus F. Brackett . . . . . Professor of Physics.
George Macloskie . . . . . Professor of Natural History.
Charles A. Young . . . . . Professor of Astronomy.
Charles G. Rockwood, jun. . . Professor of Mathematics.
William Libbey, jun. . . . . . Assistant Professor in Natural Science.

Jersey City.

John W. Atwood . . . . . . Teacher.
George W. C. Phillips . . . Druggist.
Beriah A. Watson . . . . . Physician.
Erminnie A. Smith.

New Brunswick.

George B. Merriman . . . . Professor Rutgers College.
Peter T. Austen . . . . . . Professor.
F. C. Van Dyck . . . . . . Professor.
George H. Cook.

Newark.

C. C. Hine . . . . Publisher.
Edward Weston . . . . . Weston Electric Light.
James E. Howell . . . . . Lawyer.

Orange.

Henry C. Pedder.
Francis R. Upton.
James D. Hague . . . . . Mining Engineer.

Vineland.

J. W. Pike.
Mary Treat.
Caroline A. Paul.

Trenton.

Charles C. Abbott . . . . . Archæologist.
Edward I. Green.

Freehold.

Samuel Lockwood . . . . . Clergyman.

Hoboken.

Robert H. Thurston . . . . Stevens Institute of Technology.

Millville.

R. M. Atwater.

Somerville.

Mrs. A. B. Blackwell.

PENNSYLVANIA.

Philadelphia.

UNIVERSITY OF PENNSYLVANIA.

Joseph Leidy . . . . Professor of Anatomy.
E. Otis Kendall . . . . . . Professor of Mathematics.
Frederick A Genth . . . . Professor of Chemistry.
George F. Barker . . . . . Professor of Physics.

IN GENERAL.

S. Weir Mitchell . . . . . . Physician.
John L. LeConte . . . . . Physician.
Frances Emily White . . . . Physician.
F. Woodbury . . . . Physician.
Charles A. Ashburner . . . Geologist.
Persifor Frazer . . . . . . Geologist.
Academy of Natural Science of Philadelphia.
Second Geological Survey of Pennsylvania.
Library Company.
Mercantile Library . . . . . Tenth Street.
Martin Roche . . . . . . Nautical and Engineering College.
William H. Walmsley . . . Representative R. & J. Beck.
D. R. Goodwin . . . . . . Clergyman.
Henry C. McCook . . . . . Clergyman.
William Sellers . . . . . . Wm. Sellers & Co., Machinists' Tools.
William S. Auchincloss . . . Bates & Auchincloss, Spool Cotton.
Charles B. Penrose . . . . . Physicist.
Edwin J. Houston . . . . . Manager, 1426 Callowhill.
William Ludlow . . . . . . Major of Engineers.
William L. Abbott . . . . . 1926 Chestnut Street.
Fairman Rogers . . . . . . 202 South 19th Street.
H. Allen . . . . 3706 Locust Street.
Isaac Lea . . . . 1622 Locust Street.
F. V. Hayden.
A. E. Outerbridge, jun.
John H. Redfield.
J. P. Pyle.
John Bigelow.
Mrs. M. Mott Davis.

Altoona.

Charles B. Dudley.
F. N. Pease.
John W. Cloud.

Wilkesbarre.

Irving A. Stearns . . . . . Civil and Mining Engineer.
R. Bruce Ricketts.
Harrison Wright.

Allegheney.

Western University of Pennsylvania.
William M. Herron . . . . Physician.

Easton.

Thomas M. Drown . . . . Professor and Chemist.
Traill Green . . . . Professor.

Pittsburgh.

Joseph D. Weeks . . . . . Associate Editor "The Iron Age."
John H. Ricketson . . . . . Founder, Machinist, and Manufacturer.

West Chester.

D. M. Sensenig . . . . Professor.
Halliday Jackson.

Bethlehem.

Edward H. Williams, jun. . . Professor Lehigh University.

Chester.

Walter N. Hill.

Cookport.

Dr. Stewart . . . . Physician.

Delaware Water-Gap.

S. W. Knipe . . . . Clergyman.

Drifton.

Eckley B. Coxe.

Germantown.

Henry Carvill Lewis . . . . American Acad. of Natural Sciences.

Hulton.

C. Alfred Smith.

Huntingdon.

Joseph E. Saylor . . . . . . Professor Normal College.

Lancaster City.

Jefferson E. Kershner . . . Professor Franklin and Marshall Coll.

Latitz.

H. A. Brickenstein.

Manayunk Post-Office.

J. Addison Campbell.

Mansfield Valley.

Francis C. Blake . . . . . . Pennsylvania Lead-Works.

Meadville.

City Library.

Pittston.

R. D. Lacoe.

DELAWARE.

Newark.

T. R. Wolf . . . . Physician.

Wilmington.

J. H. Kidder . . . . U.S.A. Fish Com. S.S. 'Albatross.'

MARYLAND.

Baltimore.

JOHNS HOPKINS UNIVERSITY.

Daniel C. Gilman . . . . . President Johns Hopkins University.
H. Newell Martin . . . . . Professor Biology.
Ira Remsen . . . . Professor Chemistry.
Henry A. Rowland . . . . Professor Physics.
Richard M. Venable . . . . Professor Constitutional Law.
William K. Brooks . . . . Associate Professor Biology.
William Hand Browne . . . Associate Librarian.
Thomas Craig . . . . Associate Prof. Applied Mathematics.
William T. Sedgwick . . . . Associate Professor Biology.
William E. Story . . . . . Associate Professor Mathematics.
Philip R. Uhler . . . . . . Associate Professor Natural History.
Nicholas Murray . . . . . Johns Hopkins University.
A. H. Tuttle . . . . Student.
Arthur S. Hathaway . . . . Graduate Student, Johns Hopkins Univ.
Andrew A. Veblen . . . . Graduate Student, Johns Hopkins Univ.

IN GENERAL.

State Normal School.
Peabody Institute.
W. Simon . . . . Physician.
W. Chew Van Bibber . . . . Physician.
Alan P. Smith . . . . . . Physician.
Gustav A. Liebig . . . . . Physician.
Charles I. M. Gwinn . . . . Attorney-General of Maryland.
Thomas Turtle . . . . . . United-States Engineer.
William H. Numsen . . . . 18 Light Street.
Edgar G. Miller . . . . . . 279 Baltimore Street.

Annapolis.

UNITED-STATES NAVAL ACADEMY.

Naval Academy Club.
J. M. Rice . . . . Professor of Mechanics.
William Woolsey Johnson . . Professor of Mechanics

N. M. Terry	Professor of Physics.
J. B. Murdock	Department of Physics and Chemistry.
George W. Jones.	

St. Denis.

George W. Dobbin.
Nicholas G. Penniman.

Mount Washington.

P. G. Sauerwein.

Woodstock.

B. Sestini	Clergyman.

DISTRICT OF COLUMBIA.

Washington.

Robert Todd Lincoln	Secretary of War.
Benjamin Alvord	Brigadier-General U.S.A.
William A. Richardson	Judge Court of Claims.
H. A. Scudder	Judge.
John Jay Knox	Comptroller of the Treasury.
Spencer F. Baird	Secretary Smithsonian Institution.
G. Brown Goode	Curator Smithsonian Institution.
Richard Rathbun	Smithsonian Institution.
Theodore Gill	Smithsonian Institution.
George P. Merrill	Smithsonian Institution.
Frederick W. Taylor	Chemist, Smithsonian Institution.
C. A. White	Paleontologist, Smithsonian Institution.
Newton P. Scudder	Assistant Librarian, Smithsonian Inst.
E. E. Hayden	Smithsonian Institution.
James E. Benedict	Smithsonian Institution.
J. M. Flint	Smithsonian Institution.
R. S. Tarr	Smithsonian Institution.
George B. Loring	Commissioner, Dept. of Agriculture.
E. A. Carman	Chief, Department of Agriculture.
C. V. Riley	Entomologist, Dept. of Agriculture.
B. Pickman Mann	Entomologist, Dept. of Agriculture.
William T. Hornaday	Taxidermist, National Museum.
E. M. Gallaudet	President Deaf-Mute College.
J. W. Chickering, jun.	Professor Deaf-Mute College.
Ezekiel B. Elliott	Actuary, Treasury Department.
O. H. Irish	Chief Bureau of Engrav. and Printing.
Garrick Mallery	Bureau of Ethnology.
H. W. Henshaw	Bureau of Ethnology.
Henry Gannett	Census Bureau.
Edward Weston	Proprietor Portland Flats.
Gardiner G. Hubbard	Lawyer and Capitalist.
Samuel Shellabarger	Lawyer.
J. H. Saville	Lawyer.
William Birney	Lawyer and President School Board.
Charles J. Bell	Banker.
George W. Brown	Real Estate.
Alexander Melville Bell	Author of Visible Speech.
Alexander Graham Bell	Inventor of Telephone.
Sumner Tainter	Electrician.
Chichester A. Bell	Electrician.
George T. Stagg	Pres't Whiskey-Distillers' Association.
A. Brentano & Co.	Booksellers and Periodical Dealers.
W. B. Hazen	Chief, Signal Service.
Cleveland Abbé	Signal Service.
George A. Warren	Signal Service.
H. A. Hazen	Signal Service.
Winslow Upton	Signal Service.
William Ferrel	Signal Service.
T. Russell	Signal Service.
S. I. Kimball	Life-Saving Service.
E. W. Clark	Revenue Marine.
Joseph E. Hilgard	Coast and Geodetic Survey.
Richard D. Cutts	Coast and Geodetic Survey.
Charles S. Peirce	Mathemat., Coast and Geodetic Survey.
Edward Goodfellow	Coast and Geodetic Survey.
E. B. Lefavour	Mathematician, Coast Survey.
Henry Farquhar	Coast and Geodetic Survey.
Alexander S. Christie	Coast and Geodetic Survey.
William H. Dall	Coast and Geodetic Survey.
H. F. Walling	Coast and Geodetic Survey.
Robert S. Avery	Coast and Geodetic Survey.
H. W. Blair	Coast and Geodetic Survey.
Edward H. Courtenay	Coast and Geodetic Survey.
Charles A. Schott	Photographer, Coast Survey.
Werner Suess	Coast Survey.
Asaph Hall	Astronomer, Observatory.
Albert S. Flint	Naval Observatory.
William C. Winlock	Observatory.
Robert Fletcher	Asst. Librarian Surgeon-Gen.'s Office.
Henry C. Yarrow	Army Medical Museum.
W. M. Mew	Army Medical Museum.
Benjamin F. Pope	Surgeon-General's Office.
J. W. Powell	Geological Survey.
Clarence E. Dutton	Geological Survey.
James C. Pilling	Geological Survey.
G. K. Gilbert	Geological Survey.
Charles Darwin	Geological Survey.
Charles D. Walcott	Geological Survey.
S. F. Emmons	Geological Survey.
W. H. Holmes	Geological Survey.
Ivan Petroff	Geological Survey.
A. H. Thompson	Geological Survey.
John Eaton	Bureau of Education.
Charles Warren	Bureau of Education.
R. L. Packard	Bureau of Education.
H. R. Bigelow	Physician.
D. W. Prentiss	Physician.
W. W. Godding	Physician.
J. W. Osborne	212 Delaware Avenue, N. W.
David P. Heap	United States Engineers.
T. C. Chamberlin	Box 591.
W. C. Kerr	803 G Street, N. W.
James C. Welling	1330 19th Street.
M. Covarrubias	1418 K Street.
Henry Adams	1607 H Street.
Benjamin Miller	Georgetown, D.C.
Mrs. Caroline H. Dall	Georgetown, D.C.
Signal Service	War Department.
Director of the Mint	Treasury Department.
Lighthouse Board	Treasury Department.
Life-Saving Service	Treasury Department.
Chief of Engineers	War Department.
Surgeon-General's Office.	
Nautical Almanac Office.	
Patent Office	Department of the Interior.
Division of Mining Statistics	Geological Survey.
Library	Geological Survey.
Rocky-Mountain Division	Geological Survey.
National Museum	Smithsonian Institution.
Bureau of Medicine and Surgery.	
Department of Agriculture.	
Scientific Library	United-States Patent-Office.
Coast and Geodetic Survey.	
Bureau of Education	Department of the Interior.
Naval Observatory Library	Observatory.
C. O. Boutelle	U. S. Coast and Geodetic Survey.
Alexander Ziwet	U. S. Coast and Geodetic Survey.
Miles Rock	U. S. Naval Observatory.
William H. Hawkes	Physician.
Frederick W. True	Librarian, U. S. National Museum.
Julius Baumgarten	Engraver.
W. W. Upton	Second Comptroller, Treasury.
M. C. Meigs	Brigadier-General U.S.A.
George W. Hill	Nautical Almanac Office.
Edson A. Burdick	406 Spruce Street.
W. W. Corcoran	Founder Corcoran Art-Gallery.
Thomas Taylor	Department of Agriculture.
J. C. McGuire	
William D. Baldwin	Baldwin, Hopkins, & Peyton, Patent Solicitors.
Elliott Coues	Author and Naturalist.
William E. Woodbridge.	
Charles W. Smiley.	
John H. C. Coffin	Professor of Mathematics.
E. S. Hutchinson.	
M. S. Fallo	1200 Eighteenth Street.

WEST VIRGINIA.

Morgantown.

I. C. White	Professor University of West Virginia.

VIRGINIA.

University of Virginia.

William M. Fountaine.
Ormond Stone.

Norfolk.

Newton Fitz	Prof. Norfolk College for Young Ladies.
William J. Moore	Physician.
C. O. Boutelle	U. S. Coast and Geodetic Survey.

Lexington.

S. T. Moreland	Washington and Lee University.

Portsmouth.

Henry C. Jordan	Clerk.

KENTUCKY.

Lexington.

Ballard, Williamson, & Co.
Alfred M. Peter.

Earlington.

John B. Atkinson.

Danville.

J. C. Fales	Centre College.

Frankfort.

E. H. Taylor, jun., Company	Distillers

Louisville.

Miss A. V. Pollard	Librarian of Polytechnic Society.

Richmond.

Edward L. Nichols . . . . Professor Central University.

NORTH CAROLINA.

Davidson College Post-Office.

J. R. Blake . . . . Professor.

Raleigh.

North Carolina Agricultural Experiment Station.

TENNESSEE.

Nashville.

VANDERBILT UNIVERSITY.

Vanderbilt University . . . . Library.
N. T. Lupton . . . . Vanderbilt University.
James M. Safford . . . . . Vanderbilt University.

Lebanon.

J. I. D. Hinds . . . . . . Professor.

SOUTH CAROLINA.

Sumter.

Benjamin Hodges.

GEORGIA.

Augusta.

C. B. F. Lowe . . . . . . Georgia Chemical Works.

Nacooche.

Josiah Curtis . . . . Physician.

FLORIDA.

Jacksonville.

A. S. Baldwin . . . . . . Physician.
Thomas Bassnett.

Pensacola.

Silas Stearns.

ALABAMA.

Greensboro'.

Charles Jones.

Moulton.

Thomas M. Peters . . . . . Judge.

Tuscaloosa.

Eugene A. Smith . . . . . Professor University of Alabama.

LOUISIANA.

New Orleans.

Alcée Fortier. . . . . . . University of Louisiana, Academical Department.
Alfred Mercier . . . . . . Secrétaire perpétuel, Athenée Louisiane.

OHIO.

Cincinnati.

Frank Wigglesworth Clarke . Prof. of Chemistry, Univ. of Cincinnati.
Edward Wyllys Hyde . . . Prof. Mathematics, Univ. of Cincinnati.
Fred A. Roeder . . . . . . Demonstrator of Chemistry, Ohio Medical College.
Andrew J. Howe . . . . . Surgeon.
John M. Scudder . . . . . Physician and Surgeon.
Theodore L. A. Greve . . . Pharmacist.
W. H. Venable . . . . . . Principal Chickering Institute.
Jacob D. Cox . . . . Dean Cincinnati College.
E. S. Wayne . . . . Analytical Chemist.
Aaron F. Perry . . . . . . Attorney.
Henry H. Vail . . . . . . Publisher.
H. W. Hughes . . . . . . President Union National Bank.
Ohio Mechanics Institute.
Y. M. Mercantile Library Association.
Eliot A. Kebler.
Robert Clarke & Co. . . . . Booksellers and Publishers.

Cleveland.

W. J. Gordon . . . . . . President Mercantile Insurance Co.
S. H. Freeman.
Arthur F. Taylor . . . . . Professor of Chemistry, Case School.
Case School of Applied Science.
H. D. Dennis.
J. H. A. Bone . . . . . . Secretary Herald Publishing Company.

Columbus.

OHIO STATE UNIVERSITY.

L. Lesquereux . . . . . . Professor of Geology.
Edward Orton . . . . . . Professor Ohio State University.
Newton M. Anderson . . . . Teacher State University.
T. C. Mendenhall . . . . . Professor Ohio State University.

IN GENERAL.

Ohio Agricultural Experiment Station.
Henry Snyder, jun. . . . . Teacher Institution for Blind.
William R. Lazenby.

Springfield.

F. M Bookwalter . . . . . Manager for James Leffel & Co.
T. J. Kirkpatrick . . . . . Editor "Farm and Fireside."
Linus E. Russell . . . . . Physician.

Akron.

Charles M. Knight . . . . . 254 Carroll Street.

Cuyahoga Falls.

Elisha N. Sill.

Gambier.

Theodore Sterling . . . . . Professor Kenyon College.

Georgetown.

Thomas W. Gordon . . . . Physician.

Mount Lookout.

H. C. Wilson . . . . Cincinnati Observatory.

Navarre.

John F. Grossklaus.

North Bend.

Robert B. Warder.

Oberlin.

George F. Wright . . . . . Professor of New-Testament Literature, Oberlin College.

Portsmouth.

G. S. B. Hempstead . . . . Physician.

Urbana.

Thomas French, jun.

Round-Head Post-Office.

P. Manchester.

South Bass Island.

Joseph de Rivera.

Toledo.

Charles W. Bond . . . . . Groceries and Commission.

Waynesville.

I. H. Harris.

Wyoming.

George M. Maxwell . . . . Clergyman.

MICHIGAN.

Ann Arbor.

UNIVERSITY OF MICHIGAN.

William H. Pettee . . . . . Professor of Mineralogy.
John W. Langley . . . . . Professor of Chemistry.
Mark W. Harrington . . . . Professor of Astronomy.
Alexander Winchell . . . . Professor of Geology.
Charles K. Wead . . . . . Professor of Physics.

Lansing.

W. J. Beal . . . . Professor of Botany, State Agricultural College.
R. C. Kedzie . . . . Professor.

Jackson.

Mrs. P. B. Loomis.

Muskegon.

Frank H. Bassett.

INDIANA.

Bloomington.

Julia R. Hughes.
David S. Jordan . . . . . . Professor University of Indiana.
Daniel Kirkwood . . . . . Professor University of Indiana.

Brookville.

Amos W. Butler.

Connersville.

Robert Hessler.

Indianapolis.

Isabella King . . . . Critic teacher.

Lawrenceburg.

J. E. Larimer.

New Harmony.

Richard Owen . . . . . . Geologist.

ILLINOIS.

Chicago.

E. S. Bastin . . . . Professor.
Public Library.
H. A. Johnson . . . . Physician.
J. C. Arthur.
Sheldon W. Burnham . . . . Assistant Clerk U. S. Courts.
E. W. Blatchford . . . . . E. W. Blatchford & Co., Lead Pipe.

Springfield.

John H. Rauch . . . . . . State Board of Health.
A. H. Worthen . . . . State Geologist's Office.

Belleville.

John J. R. Patrick.

Cairo.

John G. D. Knight.

Englewood.

E. J. Hill.

Evanston.

H. S. Carhart. . . . . Prof. of Physics, North-western Univ.

Galesburg.

Milton L. Comstock . . . . Professor Knox College.

Lima.

Charles T. Dazey . . . . . Poet and Dramatist.

Normal.

State Laboratory of Natural History.

Rockford.

L. A. Weyburn.

WISCONSIN.

Madison.

Library of Washburn Observatory.
University of Wisconsin.

Milwaukee.

Public Library.
Lewis Sherman . . . . Physician.

Beloit.

Beloit College Library.

Ripon.

Ripon College Reading-Room.

Trempealeau.

G. H. Squier.

MINNESOTA.

Minneapolis.

James A. Dodge . . . . . Professor of Chemistry, Univ. of Minn.
University of Minnesota.

St. Paul.

Edward Maguire . . . . . Captain of Engineers U.S.A.
Hubert H. Miller . . . . . Analytical Chemist.

Northfield.

Andrew A. Veblen.

IOWA.

Davenport.

Charles E. Putnam . . . . . Viles Block, Main Street.
Asa S. Tiffany . . . . . . 901 West 5th Street.

Ames.

Charles E. Bessey . . . . . Professor Agricultural College.

Burlington.

W. H. Hopkirk . . . . . . 2003 Madison Street.

Dubuque.

Asa Horr . . . . 1311 Main Street.

Iowa City.

Gustavus Hinrichs.

NEBRASKA.

David City.

R. Ellsworth Call . . . . . Principal City Schools.

Lincoln.

Samuel Aughey . . . . . . Professor.

MISSOURI.

St. Louis.

WASHINGTON UNIVERSITY.

Henry Hitchcock . . . . . Professor Constitutional Law.
Marshall S. Snow . . . . . Professor History.
Edmund A. Engler . . . . Professor Mathematics.
Academy of Science.

IN GENERAL.

George Engelmann . . . . Physician.
G. S. Walker . . . . Physician.
James H. McLean . . . . . Physician.
Lawrence L. King . . . . . King's Insurance Agency.
Robert E. McMath . . . . . Civil Engineer.
James B. Eads . . . . Civil Engineer.
Samuel Marsden . . . . . Builder.
William H. Pulsifer . . . . President St. Louis Lead & Oil Co.
George L. Joy . . . . . . Joy & Chapman, Salt-Dealers.
Edward Mallinckrodt . . . . G. Mallinckrodt & Co., Chemists.
William Glasgow, jun. . . . 3016 Glasgow Place.
F. V. Abbot . . . . 404 Market Street.
A. F. Dean . . . . Gen. Agt. Springfield F. and M. Ins. Co.
Public School Library. . . . Polytechnic Building.

Columbia.

University of State of Missouri.
S. M. Tracy . . . . Professor State University.

Liberty.

Library of William Jewell College.
J. R. Eaton . . . . Professor.

Jefferson City.

G. N. Grisham . . . . . . Lincoln Institute.

Seventy-Six Post-Office.

Miss Virginia K. Bowers.

KANSAS.

Lawrence.

F. H. Snow.
L. L. Dyche.
H. S. S. Smith . . . . . . Professor.

Fort Leavenworth.

O. M. Carter.
W. A. Glassford . . . . . 2d Lieutenant Signal Corps, U. S. A.

Manhattan.

E. A. Popenoe . . . . . . Professor.

COLORADO.

Denver.

Sidney H. Short . . . . . . Professor University of Denver.
H. A. Howe . . . . Professor University of Denver.
Benjamin H. Smith . . . . Surveyor-General's Office.
William A. Peck . . . . . Surveyor-General's Office.
Robert A. Meier . . . . . 542 California Street.
United States Geological Survey.

Colorado Springs.

Colorado College Library.
George H. Stone.

Golden.

Colorado State School of Mines.
Arthur Lakes . . . . Professor School of Mines.

Nepesta.

John McDaniell.

ARKANSAS.

Fayetteville.

A. V. Lane . . . . Civil Engineer.

Little Rock.

Thomas H. H. Handbury . . Corps of Engineers U.S.A.

Malvern.

Louis Guerineau.

Van Buren.

Miss Juanita A. Bourland . . Main Street.

TEXAS.

Corsicana.

J. K. Smyrl.

Galveston.

Samuel M. Mansfield . . . . Brevet Lieut.-Col. in charge U. S. Corps Engineers.

NEVADA.

Candelaria.

W. H. Shockley.

CALIFORNIA.

San Francisco.

Library U. S. Geological Survey.
California Academy of Science.
George F. Becket . . . . . U. S. Geological Survey.
G. M. Sternberg. . . . . . Physician U.S.A., Fort Mason.
Ivan Petroff . . . . Alaska Commercial Co.
R. L. Floyd . . . . Captain.

Berkeley.

UNIVERSITY OF CALIFORNIA.

Library of University of California.
Eugene W. Hilgard . . . . Prof. Agriculture, University of Cal.
Joseph Le Conte . . . . . Prof. Geology, University of California.

Oakland.

Thomas H. Pinkerton . . . Physician and Surgeon.
Aurelius H. Agard. . . . . Physician.

Carpenteria.

Robert Cauch . . . . . . Physician.

Livermore.

Philo. F. Phelps.

Los Angeles.

Marcus Baker . . . . . . Coast Survey.

Salinas.

E. K. Abbott. . . . . . . Physician.

San José.

F. W. Simonds . . . . . . Professor.

ALASKA TERRITORY.

Sitka.

E. O'C. Acker . . . . . . U. S. S. 'Adams.'

ARIZONA.

Prescott.

G. J. Fiebeger . . . . . . Lieutenant Corps of Engineers U.S.A.

DAKOTA TERRITORY.

Fort Yates.

C. H. Alden . . . . Physician U.S.A.

MONTANA.

Butte City.

S. M. Pitman.

Helena.

"Helena Independent."

UTAH.

Salt Lake City.

I. C. Russell . . . . U. S. Geological Survey.
W. J. McGee. . . . . . . U. S. Geological Survey.
Library U. S. Geological Survey.

FRANCE.

Paris.

Octavo Uzanne . . . . . . Editor "Le Livre."

SWITZERLAND.

Cham.

Anglo-Swiss Condensed Milk Co.

CANADA.

Montreal.

MCGILL UNIVERSITY.

John William Dawson . . . Principal.
William Osler . . . . . . Professor Institutes of Medicine.
Henry T. Bovey. . . . . . Professor of Civil Engineering.

IN GENERAL

Thomas Sterry Hunt.. . . . Geologist and Mineralogist.
Thomas B. Wheeler . . . . Physician.
Robert C. Adams . . . . . Exporter and Importer.
George John Bowles . . . . Secretary and Treasurer British American Bank Note Co.

Ottawa, Ont.

Alfred R. C. Selwyn . . . . Division Geological Survey.
W. H. Harrington . . . . . Post-Office Department.

Halifax.

James G. MacGregor. . . . Professor Dalhousie College.
Robert Morrow . . . . Wm. Stairs, Son, & Morrow, Hardware.

Clinton, Ont.

Horatio Hale.

Dartmouth.

John Forbes . . . . Manager Starr Manufacturing Co.

Fredericton, N.B.

W. Brydone Jack . . . . . Pres. University of New Brunswick.
Loring W. Bailey . . . . . Professor.

Grand Manan, N.B.

Simeon F. Cheeney . . . . Woodward's Cove.

Guelph, Ont.

A. T. Deacon. . . . . Bursar Ontario Agricultural College.

Kingston, Ont.

Herbert A. Baym.

London, Ont.

The Entomological Society of Ontario.

Quebec.

J. C. K. Laflamme . . . . . Professor Laval University.

St. John, N.B.

John March . . . . Secretary Board School Trustees.

Toronto.

Goldwin Smith . . . . Professor.

Winnipeg, Man.

J. Hoyes Panton . . . . . . Professor.

CUBA.

Habana.

Adolfo Moliner.
J. S. Jorrin.

BRAZIL.

Rio de Janeiro.

J. Charles Berrini . . . . . Physician.
Orville A. Derby

PERU.

Iquique.

J. W. Merriam . . . . . . United-States Consul.

DENMARK.

Copenhagen.

Japetus Steenstrup . . . . Professor.

ENGLAND.

Leeds.

J. J. Hummel . . . . . . Yorkshire College.

London.

Louis P. Casella.
Thomas H. Huxley . . . . Physiologist and Naturalist.

Tewksbury.

W. S. Symonds . . . . Clergyman.

FRIDAY, MARCH 23, 1883.

THE SPHERE OF THE UNITED STATES GEOLOGICAL SURVEY.

EVER since the establishment of the U. S. geological survey, in 1879, there has been a question as to the extent of the territory subject to its researches. The legislators who framed the organic law intended to make the field of investigation co-extensive with the United States; but they failed to employ unmistakable language; and the officer on whom devolved the interpretation of the law construed 'national domain' to mean only those states and territories in which are public lands. It seemed to those interested in the work, that this restriction was unwise; and a resolution to remove it was introduced in the next Congress. The House acceded without a dissenting voice, but in the Senate the cry was raised that state rights were being invaded. A political discussion ensued, and the proposition failed to reach a vote. In 1882, however, the paragraph appropriating money for the survey was so altered as to extend its operations to the whole country; at least, so far as is necessary for the preparation of a general geological map.

Under the authority thus granted, several new works have been initiated, and two investigations already begun have been carried into new territory. Of the new undertakings, the most important are geographic. Three topographic parties and one triangulation party were sent to the Appalachian mountains in North Carolina, and adjacent portions of Tennessee, Kentucky, Virginia, and West Virginia; and a base-line was measured in Arkansas as a first step toward the mapping of the Ozark mountains. An investigation of the mesozoic strata of eastern Virginia, North Carolina, and Maryland, already begun by Prof. William M. Fontaine, was taken up by the survey; and a beginning was made in the study of the Orange Sand of the Gulf States. The works previously instituted, but now extended to new ground, were the study of the northern drift, by Prof. T. C. Chamberlin, and the study of the copper-bearing rocks of the Lake Superior region, by Prof. R. D. Irving.

The temporary restriction to which the survey was subjected led to a free discussion, not only of the constitutional competence of the nation to investigate the mineral resources of the states, but of the proper functions of a scientific survey endowed by the government, and of the relative functions of national and state geological surveys. The fact was developed, that the directors of the existing state surveys, almost without exception, favored the establishment of a national survey, but that the wisdom of the measure was questioned by several geologists not directly connected with state work. The chief ground of objection appeared to be, that the local interest essential to thorough local work could be best secured by local organizations; the chief ground of support, that the work in each state must develop scientific problems soluble only by investigations carried beyond the lines of the state. Those who recognize both these considerations hope that the inauguration of the national work will not be followed by any abatement of state work. Certainly there is ample room for both; and a national survey is no more competent to discuss local questions than are state surveys to answer those of a general nature. With a proper differentiation of function, there need be no more overlapping of work than is necessary to promote salutary discussion. So far as indicated by its initial work, the national survey purposes to confine its attention to researches the subjects of which lie in several states, and the results of which have more than a local interest. Professor Irving's investigation of the copper-bearing rocks leads him, of necessity, into three states; and Professor Chamberlin's study of the great moraine marking the second division of the glacial epoch, has carried him and his assistants into thirteen states and one territory. The scientific value of a national organization is especially illustrated by the latter work. While Professor Chamberlin has had the advantage of a great body of published material, he nevertheless owes to the U. S. survey the opportunity of tracing, and uniting

into one continuous chain, some three thousand miles of terminal moraine. If this comprehensive view had been possible to some geologist twenty years ago, how different might be the literature of our drift!

IMPROVEMENT OF THE NATIVE PASTURE-LANDS OF THE FAR WEST.

It is a well-known fact, that the greater part of the United States west of the meridian of Omaha is unfit for tillage. Here and there, there are strips of land, which have a larger rainfall, that may be brought under the plough; and along the rivers there are narrow belts of land that may be made tillable by irrigation. A portion of this region is utterly barren; but a large part of it — probably not far from one million square miles of the whole area, or an area nearly one hundred times the surface of Massachusetts — bears a scanty crop of grasses. The natural use of this region is already recognized: its sole worth is for the pasturage of cattle and sheep. Already a great herding industry has been created in this region, — one that has an important bearing on the food-supply of this country and of Europe. The only limitation on the great extension of this industry is found in the scantiness of the herbage and the inadequacy of the water-supply. The latter evil is probably remediable, in most cases at least, by wells or by storage-reservoirs, which shall retain the abundant waterfall of the rainy season. I propose to offer some suggestions concerning the possibility of bettering the herbage of forage-plants.

All the grasses that now grow in that region make but a scanty herbage. I am informed by stock-raisers, that the best 'ranges' require from fifteen to twenty acres to a head of horned cattle, and that from this unusual goodness the 'ranges' decline in value, until, in many districts, a hundred acres is required to supply a beast. The wide extent of the ranges necessary to afford pasturage to herds of profitable numbers makes the supply of water more difficult than it otherwise would be.

It seems to me possible that the pasturage of this region might be materially improved by the introduction of grasses and other forage-plants indigenous to regions having something like the same conditions of climate. My reasons for hope in this matter are substantially as follows: the experience of settlement in this country shows that the grasses are more easily feralized than any other of our domesticated plants; several of them show a willingness to escape to the wilderness; so that there is hope that a careful selection in various lands might afford some other species that would run wild on our dry plains and mountains. European experiments in naturalizing grasses have been fairly successful, as in the case of grasses to protect dunes from the action of the wind.

There are many regions in the world where grasses have developed to suit just such conditions as we have on our plains; and in some of those regions the period for the process of development to go on has been far longer than in North America. In North America it has been but a single geological period since the vegetation of the plains and Rocky Mountains was well watered; while in Australia it seems likely that the dryness of the climate has been in existence from a rather remote past. The same is probably the case in the northern parts of Asia and in South Africa. Good effects from the introduction of foreign forage-plants may be hoped for, if the only result were an increase in the variety of the herbage on the plains. With the poorest grasses there are generally wide interspaces between the tussocks of high-growing species. If these intervals could be filled with other forage-plants, the consequence would be a greater amount of food to the acre.

In the effort to naturalize foreign species of forage-plants, attention should be paid to all forms of plants that can afford pasturage or browsing. There are many forms that would be likely to do well along the streams, that might not succeed so well in the open country.

The regions that are likely to furnish plants calculated to flourish in a region of low rainfall include a large part of the earth's surface. Those that would succeed in Dakota are not likely to do well in Texas or Arizona. For the northern region, the uplands of northern Asia or of Patagonia are the most promising fields of search; while, for the middle and southern fields, the valley of the La Plata, southern Africa, Australia, and the Algerian district, may be looked to for suitable species.

The experiment is naturally one for the federal government to undertake, but it need not be costly. Three experimental stations — one in the northern part of Nebraska, one in Texas, and one in Arizona — would serve the needs of a thorough trial. Ten thousand dollars per annum at each station should meet all the expenses of a sufficient trial; at least, until it was proven that the experiment would be successful. If we add the expenses of a travelling student of wild forage-plants (perhaps

another five thousand dollars), we would have a sufficient basis for practical work. If the result should be to increase by only one-tenth the beast-maintaining power of our wild lands, the effort would be worth many millions per annum to the nation. When we consider that the introduction of the species of Poa which receive the name of 'blue-grass' has manifolded the pasturage-value of the regions where it flourishes, it is evident that the project is worth consideration. N. S. SHALER.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

III.

As the electric installation at the Planier lighthouse is the newest and most complete, some further details of its arrangement will be of interest. The plan (Fig. 7) shows clearly the position of the two generators, and of the transmission-shafting which sets them in motion.

Both generators are placed upon the same masonry foundation, and their axes are in the same line. In order, however, that one may be ready to replace the other in case of accident, their shafts are keyed together; and they both turn, the one with an open, the other with a closed circuit. Between the two machines is a short column (shown in Figs. 9 and 10), which supports the guides for changing the belts from the loose to the fixed pulleys.

Each machine is divided into two circuits, shown by four terminals placed at the upper part of the frame, two at each end. The two

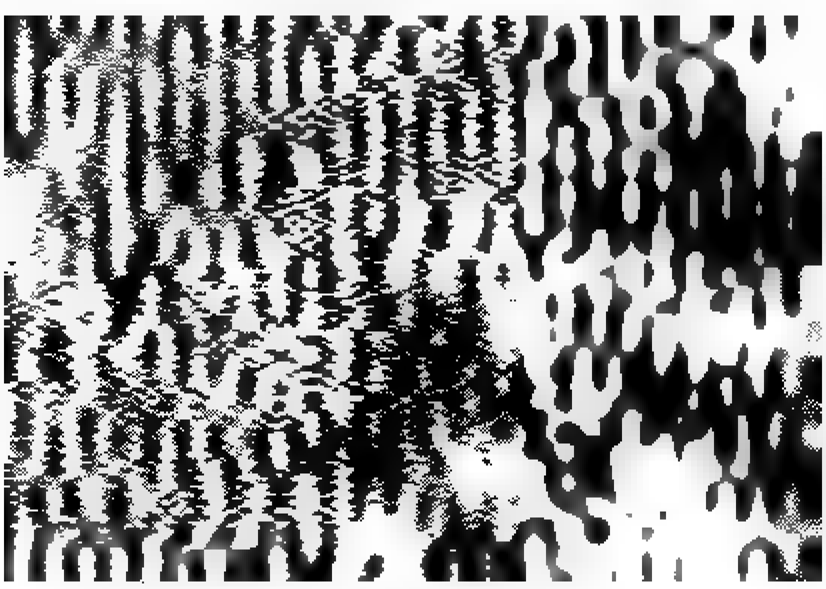


FIG. 9.

terminals placed beside each other at each end of the machine are those which at a given instant form poles of the same name. From each of them is led a copper conductor to the foot of the machine; thence, along the masonry foundation, it follows the ground (as shown in Figs. 9 and 10), and arrives at a commutator

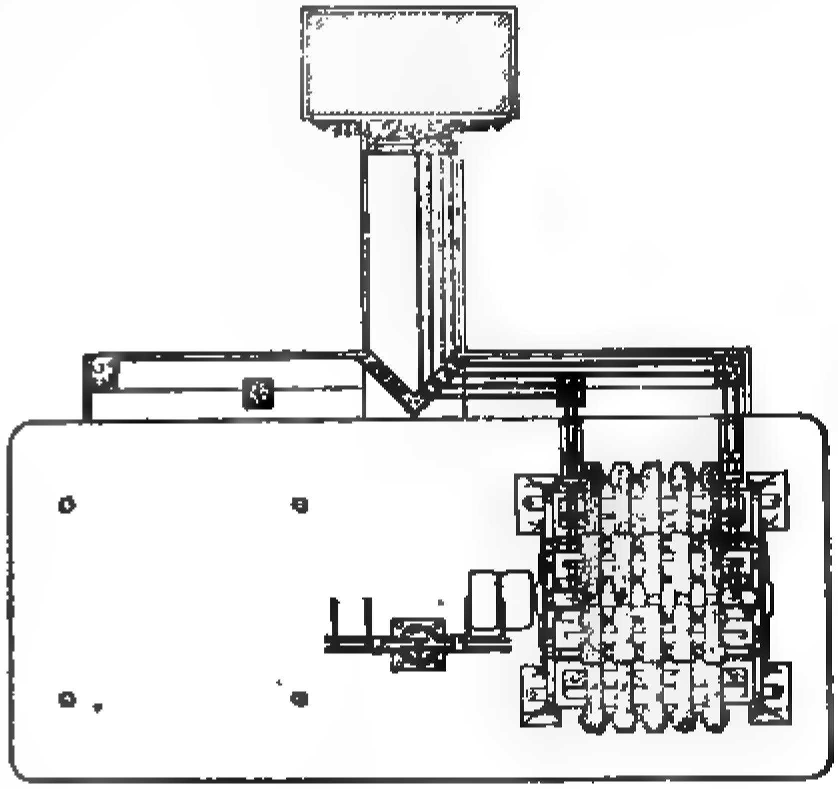


FIG. 10.

placed on the masonry column, which forms one support of the shafting. One object of the commutator is to take the current at will from either machine; another is to couple, either in tension or quantity, the two circuits of each machine. The four possible combinations of the commutator are shown in Fig. 11. An examination of this figure shows that the apparatus consists of fixed and movable contacts arranged in a circle. The first are fourteen in number. The four on the left are in relation with the terminals 1, 2, 3, 4, from which are led the conductors of the machine on the left, or machine No. 1. The four on the right are connected with the terminals corresponding with the conductors of machine No. 2. The three upper contact pieces are attached to the terminals communicating with the conductors of the lamp.

It should be said, that the current reaches the lamp by a large cable, then, after traversing the arc, is divided between two smaller cables, in one of which is placed the electro-magnet of the lamp. Of the three upper contacts, that of the left communicates with the terminal E, to which is connected the cable of the electro-magnet just mentioned; the next belongs to the terminal P C, of the second small cable; finally, the right contact, twice as large as the others, is in communication with terminal G C, of the large cable. This system of fixed contacts is completed below by three pieces,

[1] Continued from No. 6.

the centre one having double the length of the others. The side-pieces communicate by means

Fig. 11.

of auxiliary conductors, — that on the left with the contact piece of the terminal E, that on the right with the contact piece of the terminal G C.

The movable contacts, to the number of eight, are shown in the figure. They are all carried on one plate, free to move around the centre of the apparatus. The two innermost contacts are connected together so as to form a sort of U; the next pair forms a larger U; and the four others are connected, two and two, by circular strips. The different pairs of contacts are, of course, insulated from each other. A handle in the centre of the movable plate serves to place it in different positions.

Suppose, for example, that the movable contacts are in the first position shown in the figure for quantity. The terminals 1 and 2 being, at the same instant, poles of the same name, the current enters simultaneously by the two movable contacts corresponding to these terminals, and passes at the same time into the small cable and the cable in which is the electro-magnet. After passing the carbons, it is re-united in one conductor, and returns by the large cable to the terminal G C. On the fixed contact of double size, in connection with this terminal, rest the two movable contacts by which the current returns to the terminals 3 and 4.

In coupling for tension in the same machine, the current, leaving the first circuit of the machine by the terminal 1, traverses the most open pair of movable contacts, and arrives at one of the lower fixed contacts by means of the conductor auxiliary to the contact G C. It then follows the large cable, passes through the carbons, and only traverses the small cable of the electro-magnet to arrive at the terminal E; thence, by the second auxiliary conductor, to the smallest pair of movable contacts and terminal 4. It then traverses the second circuit of the machine, and returns to the terminal 3. Afterwards, by the second pair of movable contacts, it arrives at the large, lower, fixed contact, from which it is conducted by the

Fig. 12.

third pair of movable contacts to the terminal 2; that is to say, to the first circuit of the machine.

In examining the positions of the movable contacts shown for coupling machine No. 2 for tension or quantity, it will be seen that the direction of the currents is similar.

Fig. 12 gives a perspective view of this commutator. The contacts are covered with an ebonite plate, through which passes the handle for manipulating the movable plate. This ebonite plate bears four inscriptions, corresponding to the different combinations of the commutator; and an index moving with the handle indicates the combination in use.

This system has the advantage of changing instantly the grouping of the two circuits of the same machine, and of quickly substituting one machine for the other. It has, however, the drawback, common to all turning-contacts, of not being absolutely reliable.

THE HEAD-HUNTERS OF BORNEO.

IN an octavo volume of three hundred and thirty-seven pages, Carl Bock describes his journeyings into the interior and across the island of Borneo and in the island of Sumatra. The trip across Borneo, of which the book mainly treats, was undertaken at the instance of the governor of the Dutch Indies, for the purpose of making a report upon the native races of the interior, and of gathering collections of the fauna.

The author describes well; and those who read for amusement and general information will not only find the book entertaining, but will derive an excellent idea of the chief features of Bornean scenery, of its strange animal life, of the character and peculiarities of the natives, and of many curious phases of human life under the exceptional conditions of this tropical island. Scattered through the first fifteen chapters, or what may be fitly termed the diary of the trip, are very many interesting facts and observations of value to the anthropologist. But the subsequent chapters more particularly interest him, being devoted to a consideration of the province of Koetoei, and of the Dyak tribes inhabiting it. The second part treats of a limited sojourn in Sumatra, and is by far the less important, as it is the smaller portion of the volume.

Borneo is stated to be inhabited by Malays, Boegis, a couple of hundred Chinamen, and a few Klings, and by Dyaks. The Malays are chiefly confined to the coast. The Boegis, emigrants from the south part of the Celebes, are settled in one district (Koetoei), 'where they are getting numerous and powerful.' The Dyaks, who are split up into numerous independent and hostile tribes, occupy the interior of the island.

Perhaps the most important contribution to anthropologic knowledge made by Mr. Bock, is his account of the Orang Poonans, or forest people, whom he believes to be the aboriginal inhabitants of Borneo, and who are not only distinct from the neighboring Dyaks, but, in their intercourse with them, do not appear to have adopted their habits. Meeting some of the Poonan men at Long Wai, a Dyak village, he succeeded in inducing one of the chiefs to escort him to his forest home, where, however, his observations were limited to a single afternoon. According to the picture presented by the author, the Poonans would seem to be in the lowest stage of savagery. He found them almost destitute of clothing, without pottery, with few utensils (and of the simplest kind); and he confirms the belief, current in the island, that they build no dwellings properly so called, but live day and night in the open air, with no better shelter in showery weather than that afforded by an attap mat. It is possible that a longer and more intimate acquaintance with this wild people would have led to the discovery of tokens of a higher culture. The skin of the Poonans, particularly of the women, now seen by a European for the first time, is 'somewhat fairer than that of the other Dyaks,'— a result, as the author doubtless correctly surmises, of their residing in the dark forest.

A curious industry of the people is the collection of bezoar stones, which are used by the Chinese as a cure-all. The bezoar stones are of two kinds: one is derived from an external wound on a porcupine, and is supposed by the author to be composed of bits of leaves, etc., formed into a ball by the congealed blood; the other is said to be a gall-stone, found in different parts of the boehis monkey, Semnopithecus cristatus.

Head-hunting, as practised by all the Dyak tribes, is asserted to be, on what appears to be sufficient evidence, part and parcel of their religious rites. Birth and namings, marriages and burials, not to mention less important events, cannot be properly celebrated, unless the heads of a few enemies, more or less, have been secured to grace the festivities or solemnities. "Head-hunting," says the author, "is the keystone, so to speak, in the edifice of Dyak religion and character. Its perpetual practice is, no doubt, one great cause of the rapid extinction of the race."

Naturally enough, a practice so deep-rooted as this, has proved, and must continue to prove, the one great obstacle to be overcome in attempts to civilize the Dyaks.

While all the Dyaks are head-hunters, only one of the tribes, the Bahou tribe, practises cannibalism. Human flesh is eaten mainly at the feasts that follow a successful head-hunting expedition. The form of anthropophagy here disclosed seems to be somewhat analogous to that which obtained among the North-American Indians, not a few tribes of whom partook of the flesh of enemies, especially when the individuals slain were greatly renowned. At the same time, it is stated that these cannibal feasts are also given in celebration of various events, such as on the occasion of the death of a chief. Moreover, not only are the prisoners of war sacrificed, "but the richer members of the community give a number of slave-debtors (i.e., those who are sold into slavery to work out debts) to be put to death by slow torture, and eaten."

'Pomali' is a practice in vogue among the Dyaks, and also among other natives of the Malay archipelago, which seems to be somewhat allied in its nature to the tabu of the South-Sea Islander; although it appears to be less complex in its workings, and to cover much less ground, than that curious custom. As a sign that pomali is being resorted to, a bunch of maize is stuck in the ground, or baskets of rice are suspended from a bamboo post, when strangers are prohibited from entering the house or field thus pomalied.

Tattooing was found to be a common practice among the Dyaks, the women being the more elaborately ornamented. The method adopted by the professional tattooer is to first cut outlines of the intended pattern in wood, and then trace them on the body, when it is pricked in with a sharp-pointed piece of bamboo or a needle, dipped into a pigment prepared from vegetable dyes. Men are tattooed when they attain manhood, and women when about to be mar-

ried; tattooing being, with the female sex, one of the privileges of matrimony.

No communal practices appear to have attracted the author's attention; but the statement made, that among the Sandjoeng Dyaks there aré only "a couple of houses in each village, but so large as to contain between them the whole population of 400 or 500," is of interest, since it carries with it the implication of some form of communal life. In another place these communal dwellings are described as from eighty to a hundred and sixty feet in length, twenty to thirty feet in width, and with walls about ten feet high, the ridge of the roof rising another five or six feet.

The house proper has but one floor, raised on posts of ironwood about fifteen or twenty feet from the ground, which forms the actual residence, under which is a second floor, from four to six feet from the ground, which serves for many domestic purposes, to hold councils in, and as a playground for the children.

The fact, that, "whenever a deer is killed, every inhabitant of the village receives a share," the one actually shooting the animal having the right to the horns, also clearly points to the existence of well-defined hunting-laws rooted in communal principles.

Judging from the description given, the Dyaks would seem to possess many savage virtues. They were found by the author to be singularly temperate both in eating and drinking. The only native intoxicant is 'toewak,' — a drink made from wild honey. When offered brandy, they refused it, exhibiting a strong distaste even to its odor; nor could they be induced to more than taste it. They indulge to excess, however, in betel-chewing, — a habit for which they are indebted to the Malays.

In mental capacity the Dyaks are stated to be on an equality with the Malays; but they are more energetic, and more willing to work. The author attests their truthfulness, and states that thefts and robberies are entirely unknown among them. On the other hand, they were found to be most importunate beggars.

The chief industrial occupation of the Dyaks is stated to be agriculture, both sexes taking part in the labors of the field. As usual, the heavier portion falls to the lot of the women, who are said to be 'the only beasts of burden.' Rice is the main crop; but bananas, sugar-cane, and a few cocoanuts are also raised. The production, however, only suffices for immediate wants, and in times of drought great distress always ensues.

The cutting of rattan to supply the Malay trade is the next most important occupation. Considerable quantities of gutta-percha are also collected, but in so wasteful a manner, as, in the author's opinion, to threaten the future supply.

The gathering of wax from the nests of the indigenous bees is also an important industry; and twice a year the edible nests of the swallow (Hirundo esculenta) are collected for sale to the Chinese.

The medical practices of the Dyaks appear to be strictly analogous to those of other savages. Certain plants are employed as remedies; the task of concocting the medicine, and administering it, devolving mainly, as appeared to the author, upon the women, who also do what nursing is required. The main reliance, however, for the cure of disease, is in charms and sorcery.

Curiously enough, symptoms of the prevalent Darwinian theory seem to have penetrated these far-off regions; and, while visiting a village of Dyak in the interior, the author found a strong belief in the existence of people with tails in a country but a few days distant. To use his own words, "such definite statements were made to me on the subject, that I could hardly resist the temptation to penetrate myself into the stronghold of my ancestral representatives." He contented himself, however, with hiring one of the natives to go in his stead, with, needless to say, quite unsatisfactory results.

In appendices are given lists of land and fresh-water shells collected by the author in Borneo and Sumatra, with descriptions of new species; a list of birds collected on the west coast of Sumatra; a list of Sumatra butterflies; and a short vocabulary of the Long Wai (Dyak) dialect.

The volume is copiously illustrated with lithographic plates from the author's original drawings. These, if not remarkable for artistic excellence, yet serve well the purpose for which intended.

GEOLOGICAL MAP OF BELGIUM.

THE appearance of the first sheet of the new *Carte géologique de la Belgique, dressée par ordre du gouvernement* introduces to us a new system of geological cartography, which in many respects is more perfect than any thing yet attempted by a geological survey. The system adopted shows truly the real geology of the country, but gives an imperfect idea of the general distribution of the strata. This, however, can be readily shown on maps of a much smaller scale. The sheet which has just appeared is that of Cinney: it is on the scale of 1 : 20,000, the topography being indicated by 10-metre contour lines. The outcrops are drawn as they are found, and colored with even tints. The theoretical limits of the strata are defined by degraded tints of the same color as that used to designate the outcrops of the same formation. If two outcrops are visible (as with the carboniferous limestone, which is locally covered with sands), the diagrammatical extension of these is represented by fine dots of the color of the sands. The light colors in even tints are, on the contrary, reserved to represent the general disposition of the superficial quaternary and modern deposits. These have been studied carefully, especially with the help of borings; and the lettering on the map indicates the exact spot of each sounding. A short, straight, black line is used to represent the strike of the beds; and a small point, like an arrow-head, projecting from it, indicates the direction of the dip, while a number engraved on the other side of the line shows its angle. Forests where no outcrops are visible are left uncolored. Where the superficial deposits consist of the detritus of a known formation, the fact is indicated by equidistant broken lines of the same color as that used to designate the outcrop of which they are the waste.

Owing to the largeness of the scale, and the accurate topography of the maps of the war department, the geologists of Belgium have been enabled to make a true representation of the geology of Belgium as shown by the outcrops of rocks that are visible, and the superficial and surface deposits; placing on the map merely what is known and can be seen, without leaving any room for theoretical views of extension of formations to creep in and create errors, as they nearly always do. When the map is completed, it will consist of 430 sheets; besides which, there will be published a number of atlas-sheets of sections on a scale of 1:5,000. Accompanying each sheet of the map, an explanatory text will be published, containing a plate on which will be drawn three diagram-

matical sections cutting the map north and south at equal distances of twenty-seven hundred metres, showing theoretically for the whole country the subterranean distribution of the beds. In the tertiary formations an equal number of transverse sections will accompany the sheets. In the field-work, each formation will be studied monographically. One of the features of the reports will be the remarks on the subterranean hydrography. The present sheet has been prepared by the director of the survey, Mr. E. Dupont, for the carboniferous, and by Mr. Michel Mourlon for the Famennien or upper Devonian. In the accompanying text are a number of detailed sections printed on thin India paper, colored chromolithographically, and afterwards pasted in their proper place; there is also a small colored sketch-map showing the distribution of the formations in Condroz and Entre-Sambre-et-Meuse. The text is a large octavo of 66 pages.

The geological maps of Dumont have always been cited as models. By publishing the present map, the Belgian government preserves its high position as a leader in geological research. J. B. MARCOU.

LETTERS TO THE EDITOR.

Flight of the flying-fish.

IN 1871 (*Proc. Bost. soc. nat. hist.*, xiv. 137), from observation of the flying-fish in the Central-American and Hawaiian Pacific, I expressed the opinion that their flight was something more than sustaining themselves in the air by a parachute-like membrane. In the Indian ocean, in 1882, they flew from before our steamer in immense numbers; and I had ample opportunity to watch them in smooth and rough seas, and am confirmed in the statement then made, that they have the power of directing their flight. Admitting that, as a general rule, their course in the air is a continuation of their onward and upward passage through the water, and its duration as long as the expanded pectorals are moist enough to permit the rapid vibrations by which they skim along near the surface, I am sure that they can, even without touching the water with their long, lower caudal lobe, turn to the right or left, rise or fall to avoid a wave, and change direction, almost like a bird. I have often seen them sustain a flight of over a minute by my watch, and traverse several hundred yards, apparently half a mile. Their lot seems a hard one. Exposed to porpoises, dolphins, and voracious fishes, in the sea, and to marine birds in the air (happily few in these waters), what appears mere joyous amusement is really a race for life. S. KNEELAND.

Use of wire in sounding.

Since preparing the memorandum on the early use of wire in sounding (SCIENCE No. 3, p. 65), my attention has been called to two other instances of its use. It appears that the wire used by Walsh was of steel, though this is not stated in the log-book. And, in addition to the ten-pound sinker, there was a registering apparatus of six pounds' weight, designed by Maury, used on at least one of the casts, according to Capt. Belknap, but not mentioned in the record.

In the same year in which Walsh made his preparations, Capt. Barnett, R.N., of H. M. S. Thunderer, on her way to the Azores from America, sounded, August, 1849, with iron wire and a sixty-one pound sinker. Only one attempt was made, and the wire broke at 2,000 fathoms. It would seem possible, that, while the Thunderer was in America, some communication might have passed between the American and British naval officers which resulted in the attempts of Walsh and Barnett.

However, a still earlier attempt to employ wire was made, which, for the present at least, seems to be the earliest instance of its use. This was on the U.S. exploring expedition under Wilkes, when copper wire about three thirty-seconds of an inch in diameter, with twisted and soldered splices, appears to have been furnished to most of the vessels — at whose suggestion I have been unable to discover. The experiments were unsatisfactory, owing to constant parting of the wire; and, before the return of the expedition in 1842, the plan was abandoned. An admirable discussion of this topic, contributed by Capt. George E. Belknap, U.S.N., will be found in Hamersly's Naval encyclopaedia (Philadelphia, 1881).

WILLIAM H. DALL.

Peculiar faulting of a coal-bed.

In a drift opening in the Pittsburg (Ohio No. 8) coal, near this place, there is exposed a rather exceptional faulting of that seam.

The fault occurs ninety yards from the mouth of the mine, where about forty feet of strata lie over the coal. The slope of the surface is quite uniform from the opening to the point of fault, whence the rise is more rapid for a short distance, when the surface becomes a level ridge, from which it falls in all directions.

In the accompanying cut of the fault, which is longitudinal in relation to the entry, the horizontal

EAST. WEST.

dotted space represents the 'inbearing vein,' so persistent in the Pittsburg coal. The sloping checkered space represents the pulverized smutty coal on the line of fault, having a slope of about 30°. The bottom coal is very uniform as to thickness, except at the fault, where, from duplication and crushing in a horizontal direction, it is considerably thickened. The condition of the top coal is very different. From the fault to the mouth of the mine it varies from 12 to 20 inches, with a roof of slickensided 'soapstone,' while, immediately beyond the fault, it assumes a very uniform thickness of 30 inches.

On the east or under side of the fault, the edges of the layers of coal and slate partings are undisturbed, even immediately in contact with the crushed line. On the west side the layers and partings are all bent down where they come to the line of fault, as shown in the cut, in which the dark lines in the body of the coal represent slate-partings. Some of the layers of coal are pursed and distorted where they come to the fault. The immediate contact of the fault with the underlying fire-clay is concealed by a tramway. At all other parts of the fault, where it crosses the entry, its character is very plain. The wedge-shaped edge of the upper coal is cut off very abruptly at the line of fault, as prolonged at its normal slope up into the shale. The 'inbearing vein' is about twelve inches

higher on the west side of the break than on the east side, and duplicated by the lateral and upward thrust for nearly two feet before it droops to and passes into the smutty coal of the break.

From what is exposed, it appears that a part of the upper hill, at least down to and including the coal and fire-clay, has, from some cause, moved on the underlying strata; and at the fault the coal-bed has been broken and forced upon itself for two or three feet. The coal next the mouth not partaking of the motion of that farther in the hill, I could find no detritus of the removed part of the top coal, 10 to 18 inches of which is wanting from the opening to the fault. This would tend to prove that the faulting might have occurred in carboniferous times. The exposure of the roof-shales is not sufficient to prove the absence of such detritus. The condition of the coal at the line of fault would point to a geologically recent date of disturbance. Jefferson county is outside the region of glacial drift. SAMUEL HUSTON.

Richmond, Ohio.

The Leadville porphyry.

In the American naturalist for November, 1882, I find the following note :—

"*The so-called Leadville porphyry.*—Professor Alexis Julien read a paper at the Montreal meeting of the American association, on this subject, in which he described the result of his examination of the rock in question, in thin sections under the microscope. He finds that it is not an eruptive rock, but is sedimentary. Its material consists of the *débris* of the erosion of plutonic rocks redeposited in the Silurian ocean. He concludes that the rock is not a porphyry, but must be called a felsite tufa. The importance of this conclusion in estimating the form of any metallic ores contained in this deposit is obvious, and will be invaluable to mining experts."

Having spent the better part of two years in a detailed study of the Leadville region, an abstract of the results of which was published about a year since, I feel it my duty to correct any misapprehension which may arise from the above statement. The paper to which it refers I have not yet been able to see, and cannot, therefore, tell exactly to which of the many varieties of porphyry occurring at Leadville Professor Julien refers. I have seen slides of his in the possession of a gentleman at Leadville, which I have reason to believe were made from specimens of the rocks to which I gave the local name of 'gray porphyry,' and which had been labelled by him 'felspathic gneiss.' To whatever porphyry he may refer, however, I have no hesitation in saying, that his microscopical determinations have led him utterly astray. On what ground he decides from the simple inspection of a thin section of a rock of this character, whether it is sedimentary or eruptive, I am unable to conceive. Microscopical lithologists in Europe, and their pupils in this country, hesitate to do this without the aid of field-observation; and, as far as I know, it is only a few Americans who have obtained their knowledge of this science independently of such adventitious aid,—and who therefore, in their own opinion, know much more than those who originated the science,—that feel themselves competent to decide on the character of a rock without any knowledge of its field-habit or mode of occurrence. The mischievousness of this assumption is illustrated in the present case, where an utterly mistaken statement is given to the public by one whose name and position should be guaranties of scientific accuracy. Quite aside from any microscopical evidence,—as regards which, it is unnecessary to say, I differ essentially from the above-quoted statement,—*all the Leadville porphyries are most distinctly eruptive.* They occur largely as sheets between sedimentary beds, it is true; but they also cross these beds, occur as dikes, and carry within their mass larger or smaller portions of the enclosing sedimentary beds, as caught-up fragments.

To the writer of the above-quoted article, I would say, that, though in one sense a mining expert myself, I fail to see any possible use which Professor Julien's conclusions, had they been correct, would have been to me 'in estimating the form of any metallic ores contained in this deposit,' even had the Leadville ores been contained in porphyry, which, as a rule, they are not. S. F. EMMONS.

U. S. geological survey, Washington, D.C.

Sand-tracery.

My attention was called last fall to the curious markings, formed chiefly by the agency of plants and wind, on the beach of Lake Champlain. Seeing a notice of similar phenomena observed on the seashore by a correspondent in the second number of SCIENCE, I would add the following, which tends only to confirm some of his statements:—

In passing over the smooth beach of Burlington Bay, one is struck, first of all, by the porous condition of the sands just outlying the portions within reach of the waves. Unacquainted with this appearance, he might attribute it to some sand-boring insect, did not a closer observation teach him at once that it was effected by the spray, and due to the bursting of air-bubbles. The sand sifts over these holes until they are entirely concealed, or only a small opening is left, out of which one might not be surprised to see an insect emerge at any moment. He would also notice numerous tracings referable to the tracks of small animals. These are frequently regular and clean cut, and resemble impressions which are seen in the triassic sandstones of the Connecticut river. Again: a little observation stands one in good stead, as it shows these to be made by dry frizzled algae, rolled onward by the wind, as was remarked in the letter above referred to, or successively raised and dropped, making still more deceptive impressions. A leaf is often trundled along by a slight breeze, indenting the sand in a very regular, though seemingly fantastic manner.

Furthermore, I have frequently noticed a curious print made by the pliant stem of an alga, which had become attached at one end. The remaining portions, being at the sport of the wind, describe concentric circles at every point of contact. I thought at the time how little imagination would be required to endow such simple examples of nature's geometry with the higher characteristics of plants and animals. Would it not be worth while for some one who has the opportunity and leisure to make a comparative study of these markings, and determine how many of such trifling phenomena have been exalted higher than they deserve? F. H. HERRICK.

Burlington, Vt., March 1, 1883.

WHITNEY'S CLIMATIC CHANGES.[1]

III.

THE second part of this article discussed the relation of a general change of atmospheric temperature to glaciation. We now come to consider its relation to desiccation.

Because all precipitation depends on evaporation, and because rate of evaporation di-

[1] Concluded from No. 6.

minishes with the lowering of temperature, Professor Whitney conceives that a general lowering of terrestrial temperature by reason of the dissipation of solar energy will make the arid regions of the earth more arid; and he therefore cites the drying-up of rivers and lakes in regions already exceedingly dry as evidence of a general lowering of temperature. By approaching the subject from a different side we may reach a very different conclusion.

If terrestrial warmth, instead of emanating from a single celestial body, were due to an equable radiation from the whole sphere of space, there would be no atmospheric circulation. The whole air would be saturated with moisture, and the whole surface of the earth would be wet; but there would be no precipitation, no evaporation, no streams. We may therefore consider saturation the normal or static condition of the air, and wetness the normal condition of the land. The actual inequality of extraneous radiation — the relative intensity of solar radiation — is a disturbing factor. It produces atmospheric circulation, thereby causing precipitation, and diminishing the humidity of the atmosphere so that evaporation becomes possible. Precipitation is the necessary condition of evaporation. By precipitation and evaporation, inequalities are introduced in the distribution of moisture upon the surface of the land. Where precipitation preponderates, the condition becomes moister than the normal; where evaporation preponderates, it becomes drier. Excessive aridity, therefore, as well as excessive humidity, is caused by solar heat; and every increase of solar radiation tends to magnify the contrast between moist regions and dry regions, making the moist moister and the dry drier.

If our author has fallen into error in his fundamental postulates, we need not be surprised to find that facts have proved stumbling-blocks to him, and that he has involved himself in numerous inconsistencies. It will be profitable to call attention to some of these.

On p. 341 he asserts that the recession of the glaciers of the Alps is part and parcel of a general phenomenon of desiccation; and this desiccation his theory ascribes to a general lowering of temperature. On pp. 240 and 296 he notes as evidence of this same lowering of temperature the extension of glaciers in Iceland and the increased abundance of icebergs in the north Atlantic. Thus the extension of glaciers in one region, and their shrinkage in another, are both assigned to the same degradation of climate.

Having asserted that the phenomena of the glacial epoch in Scandinavia had their origin in local causes, and that the cognate phenomena, not only in the Alps, but in the Pyrenees, the Vosges, and the Caucasus, were part of the same system of events, he nevertheless declares that the ancient glacial phenomena of the Himalaya, of New Zealand, and of the Sierra Nevada, are not of sufficient importance to call for special explanation. And yet the glaciers of the Himalaya and New Zealand have shrunk, since their greatest extension, more than those of the Caucasus and Pyrenees; and the system of glaciers that has disappeared from the Sierra Nevada was greater than that ascribed to the Vosges. If the lesser changes are worthy to have a cause assigned them, why should the greater be ignored?

It is stated that the precipitation on the Sierra Nevada was very great in tertiary time, and has since continuously diminished. At a very late geological date the valleys of the range were occupied by glaciers; and the explanation given is, that the precipitation was greater then than now. But no suggestion is offered in explanation of the fact that at an earlier period, when the precipitation was still heavier, there were no more glaciers than at present.

This instance may be classed with a number of others, in which phenomena consistent with his theory are looked upon as systematic, while those of an opposite character are regarded as temporary or unimportant. The rise of the lakes of the Great Basin, since the first observations thirty-five years ago, appears to him a temporary oscillation; but the fall of the Lake of Valencia during a period of fifty years is made one of the proofs of a general desiccation, and the subsequent rise of the same lake does not find mention. The recent recession of the glaciers of the Alps is referred to a secular and general cause; but the contemporaneous advance of the glaciers of Spitzbergen is assigned a local cause, while the advance of the glaciers of New Zealand is ignored. The semi-periodic blocking of the Rofenthal by ice is mentioned as a curious anomaly, apparently without any realization that it points to a substantial uniformity of mean conditions for a period several times longer than that of the glacial recession upon which stress is laid.

One of the most curious features of the book is its assumption of the possibility of detecting evidence of a secular change of climate within the brief period of human history. To one who has the geologist's conception of geologic time the idea is so extravagant as to be fairly

grotesque. Let us consider it a moment. Silurian fossils have been found, not only in arctic and temperate regions, but within the tropics. By a slight exaggeration of the possible conditions of animal life we may admit that the general climate of the earth was then 50° C. warmer than at present. The lowest estimate that has been offered from the geologic or the astronomic stand-point for post-silurian time is five million years, which gives us a fall in temperature of one-thousandth of a degree in each century. Can it be that Professor Whitney thinks a change in temperature of one-thirtieth of a degree was sufficient to degrade Arabia from a centre of civilization to a desert? and to rob successively Persia, Greece, and Italy, of the prestige of empire? Has a change of one-hundredth of a degree so modified the climate of Greenland as to nearly depopulate it? Can it be that the same change has perceptibly modified the distribution of cultivated plants in France? Has a change of the two-thousandth part of a degree caused the Alpine glaciers to recede several thousand feet? and the Lake of Valencia to lay bare broad tracts for cultivation? And, finally, was it worth while to make a serious investigation of the thermometric data of the past century in the hope of detecting a change of the thousandth part of a degree?

TERRACES AND GRAVELS.

In one place or another our author states correctly all the fundamental principles of the action of rivers in erosion and deposition; but a strange fatality attends his application of them.

It is a conspicuous fact, that running water, under some circumstances, erodes its bed, and that, under other circumstances, it builds up its bed by deposition. The conditions which directly determine the performance of the one or the other of these functions are *load* and *velocity*. We may define the load of a stream as the ratio of its transported *débris* to the volume of its water. With a given velocity a stream is able to transport a certain load: an increase of load leads to deposition; a decrease, to erosion. Conversely, to transport a given load a certain velocity is required: an increase of velocity leads to erosion; a decrease, to deposition. Under ordinary circumstances the load of a stream at flood-stage is not subject to great variation; so that the determination of deposition or erosion is usually due to velocity. Velocity is a function of grade and volume. An increase in the angle of slope increases the velocity and tends to make a stream erode; a decrease in the angle of slope tends to produce deposition. An increase in volume gives a greater velocity and tends to induce erosion; a decrease in volume diminishes velocity and tends to induce deposition.

It follows from this, that a stream which flows with so little velocity as to form a deposit in its valley may, by an increase of volume, be made to excavate its channel more deeply, and thus abandon its old flood-plain, leaving a portion of it as a terrace on the side of its valley. If, therefore, a stream be found bordered with terraces, and if there be good reason for the belief that the inclination of the valley through which it flows has not been changed, it is proper to infer that its volume was formerly smaller. By drawing the opposite and erroneous inference, Whitney has been led to see evidence of swollen streams — and therefore of excessive precipitation — where, in reality, none exists. In point of fact, river-terraces are nearly always produced by orographic changes; and it may be doubted whether there are any localities where the effect of orographic movements can be so far eliminated as to permit fluctuations in precipitation to be inferred from river-terraces.

If Whitney had escaped this error, it is possible that he might not have been drawn into a study of geologic climate; for it enters into his original discussion of the auriferous gravels. He there infers that the pliocene rivers were large, because they deposited their load high up on the flank of the Sierra; and that the modern rivers are relatively small, because they have carved cañons in the same region. It may, indeed, be true, that the pliocene precipitation and streams were relatively great; but these facts, so far as they have any bearing, point in the opposite direction.

If, however, we dismiss the idea that the behavior of these rivers was dependent upon their volume, we can find a more plausible explanation of the phenomena by referring them to change of inclination. If the inclination of the western flank of the Sierra was exceedingly gentle in pliocene time, it would be natural for its streams to form deposits on the lower slopes; and if afterward an elevation occurred, increasing this inclination, the habit of the streams would be reversed, and the cañons we see would result. That such a change in inclination has actually taken place is rendered probable by other considerations. In the first place, the western face, which is far broader than the eastern, is, as described by Whitney and others, an inclined plain, interrupted only by the narrow cañons of the

modern streams. Its plateau character is not given by a continuous stratum of hard rock parallel to the general surface, but has been produced by the uniform erosion of a system of plicated strata. Such uniform erosion could only have been accomplished by streams flowing at a low angle. Second, the eastern boundary of the range or plateau is a line of faulting; and the orographic movement producing the range consisted of a displacement along this fault-line, and a consequent inclination of the plateau-like mass to the westward. That this movement belongs to late geologic history is strongly indicated by the fact that it is incomplete. Some unpublished observations by Mr. I. C. Russell show that a part of it has occurred since the date of the quaternary lakes of the Great Basin; and the Inyo county earthquake brings it down to 1872.

If a rise of temperature is not favorable to glaciation, if a fall of temperature does not make deserts drier, and if river-terraces are not indicative of waning precipitation, it might seem that our author's theory is badly off; but the case is not hopeless. The paleontologic evidence, and the doctrine of the dissipation of solar energy, remain; and if he will now devote himself to the investigation of the glaciers that are known to have recently increased, to the dry countries in which civilization and wealth have supplanted barbarism and poverty, and to the rivers that are engaged in filling up the valleys they once excavated, he may yet find in recent history the evidence he seeks of a secular change. G. K. GILBERT.

DEEP-SEA MEDUSAE.

Report on the deep-sea Medusae dredged by H.M.S. Challenger during the years 1873–76. By Prof. ERNST HAECKEL. London, 1882. 105 + 154 p., 32 pl. 4°.

THE expedition obtained only eighteen Medusae from deep water; and some of these, such as the beautiful Margelid, shown in plate 1, are undoubtedly surface-forms. But the value of the collection must not be estimated by its size: for some of the species are very primitive forms, or ancestral types, and are therefore of the greatest scientific interest; while others present unique and remarkable modifications of structure to adapt them to their life on the bottom.

Among the latter are the Pectyllidae, — a new family established by Haeckel, to include three genera of Medusae, obtained by the Challenger at a great depth in the Arctic Ocean, the Antarctic the Indian Ocean, and the Mediterranean. They bear a close resemblance to the Trachynemidae; but they are furnished with great numbers of ambulatory tentacles, which are wonderfully like the sucking-feet of echinoderms, terminating, like these organs, in expanded sucking-disks. As Haeckel has obtained living specimens of the Mediterranean species, and has thus been able to supplement his account of the anatomy by observations of the living animal, we have an interesting account of its habits in confinement. He says that it usually lies on its back, extends a portion of its sucking-feet stiffly out around it, and thus attaches itself to the bottom of the glass: the other sucking-feet play freely in the

Tesseranthe connectens in profile, ten times the natural size. Outline-sketch from Haeckel's Deep-sea Medusae, Pl. 15, Fig. 1.

water, as if feeling and fishing for prey, while the open mouth projects vertically upwards. It also climbs the sides of the aquarium, using its feet like a starfish.

One of the most interesting deep-sea forms is Tesserantha connectens, one of the simplest and oldest representatives of the family Tessaridae.

In his *System der Medusen*, Haeckel has given his reasons for regarding this family as the primitive form from which all the Acraspeda are descended, and he has given a figure of this species in the same place. Tesserantha is little more than a Scyphostoma, which becomes sexually mature in this larval stage. Unlike a Scyphostoma larva, it is a locomotor form, which has become adapted to a free-swimming life by the change of its oral disk into a sub-umbrella, and its basal peduncle into an apical process. In place of the simple peripheric gastric space of the Scyphostoma, it has a chamber divided by partitions into four radial pouches. This interesting

Pectyllis asteroides, anchored on its back, magnified ten diameters. Outline-sketch from Haeckel's drawing of the living animal, Deep-sea Medusae, Pl. 8, Fig. 7.

medusa, which is undoubtedly a deep-sea form, was captured in the South Pacific in 2,160 fathoms of water.

A magnificent specimen of Periphylla mirabilis, a mature male, was captured by the expedition, near New Zealand, in 1,100 fathoms of water; and it has furnished Haeckel with the material for a minute and valuable description (illustrated by eight plates) of the anatomy of this remarkable family, which shows many points of close relationship to the very simple and primitive Tessaridae and to the Lucernariadae, although it is in other respects the most highly organized of the coelenterates.

Half of the eighteen species of Medusae in the collection were Craspedotae, and half Acraspedae; and, as they represent eighteen genera and thirteen families, they present a great range of diversity, and represent most of the important types of medusa structure. Haeckel has therefore prefaced his description by a general introduction, which sets forth briefly and clearly the present state of our knowledge of the anatomy, histology, embryology, and systematic zoölogy of the Medusae as a whole. This introduction, written in English, is of great value to those who are not specialists, but yet wish to know the results of modern research on this subject. It is only proper to point out to such readers the fact, that the paper contains many statements which are not accepted, without qualification, by all naturalists: such as the assertion (on p. xxv), that, "as the formation of the gastrula by invagination of the blastula in the Medusae has been observed in very different groups, we may assume that it happens universally in this class; and supposed exceptions (e.g., Geryonia) are founded on erroneous observation." Most embryologists would certainly hesitate to believe, without verification, that Metschnikoff's careful study of the development of Liriope involves a fundamental error; and many would be disposed to doubt whether the statement on p. xv, that the Ctenophorae are derived from an Anthomedusa (Ctenaria), is fully proven.

The presence of a number of uncorrected typographical errors also detracts from the value of the paper for general readers. For instance: p. viii contains the statement, that, "as regards the two sections or sub-classes, the Craspedotae are more probably of monophylitic origin; the Acraspedae, of polyphylitic;" while other sections especially devoted to this point (11 and 14) show that the author really holds the opposite view, and believes that the Craspedotae are of polyphylitic, and the Acraspedae of monophylitic origin.

Haeckel's very extensive and minute acquaintance with all forms of Medusae qualifies him, to an exceptional degree, for speculating upon the origin and ancestral relationship of the various orders and families; and his attempt to trace the evolution of the various forms is therefore interesting to all zoölogists. In sects. 10–14 he gives a phylogenetic classification of the Medusae, the outline of which is essentially as follows: the scypy-polyps and hydro-polyps diverged from each other; and the latter became evolved along three divergent lines, thus giving rise to the tubularian hydroids, the campanularian hydroids, and a third imaginary 'trachylarian' hydroid, before any true Medusae were evolved. The Acraspedae are the descendants of the scypy-polyps, of which their Scyphostoma larva is the ontogenetic recapitulation; while the three great groups of Craspedotae are the independent descendants of the three kinds of hydro-polyps, —the Anthomedusae (e.g., Margelis), from the tubularian hydroids; the Leptomedusae (e.g.,

Encope), from the campanularian hydroids; and the Trachomedusae (e.g., Liriope) and Narcomedusae (e.g., Cunina), from the 'trachylarian' hydroids. The resemblances between the Acraspedae and the Craspedotae, and the similarity between the various orders of Craspedotae, he believes to be due to secondary modification, rather than to inheritance by descent from a common ancestral medusa.

He regards the Ctenophorae and the Siphonophorae as divergent stems from the Anthomedusae.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Astronomical applications of photography.— Prof. E. C. Pickering described some photographic work which is now being undertaken at the Harvard observatory. Experiments are being made with various lenses, and on their completion it is intended to take photographs of the whole visible heavens north of 30° south. It is possible, also, that a map will be published. Measurements of the photographic energy of all the brighter stars will be made, down to, perhaps, the seventh magnitude. Besides this, it is proposed to obtain measurements of the color of the stars by using a large lens of heavy flint-glass, giving as much chromatic aberration as possible. In the centre a circular disk of glass will be placed, slightly thinner at one edge than at the other. The effect will be, that every star will have two images placed side by side. By adjusting the sensitive-plate at a certain distance from the lens the blue rays will be brought to a focus; but, in the case of the image formed by the rim of the lens, the violet and ultra-violet rays will be spread over so large an area as to produce comparatively little effect, while in the other image they will have nearly full power. By placing another plate somewhat nearer the lens the violet rays will be focused. A third plate will enable us to focus the ultra-violet rays. By comparing, in each case, the image formed by the edge of the lens with that formed by the centre, a series of quantitative results can be obtained, which will vary according to the spectrum of the star measured. By this method any variations of color as well as of magnitude could at once be detected. — (*Amer. acad. arts sc.; meeting* Feb. 14.) [412

MATHEMATICS.

Riemann's theory. — The present paper, by Prof. Klein, is a continuation and generalization of the methods and results in his memoir, which appeared a year ago, entitled *Ueber Riemann's Theorie der Algebraischen Functionen*, etc. This last contained an extension of the Riemann theory of functions to arbitrarily given closed surfaces. There exist over these surfaces, as the author shows by physical considerations, certan potential functions, the relations between which, expressed in the language of analysis, afford the sought properties in the theory of functions. The physical considerations at first employed in order to obtain tentative results are now abandoned, and the author develops his new theory by more rigorous methods. Instead, now, of considering a Riemann's surface as a closed surface, he regards it as a *bounded* surface, or aggregate of bounded surfaces, where the different portions of the bounding curves may be regarded as being connected in pairs by any assigned law. A so-bounded surface is regarded as a portion of a closed surface; and the author shows how an important general principle is obtained, which he calls the principle of analytical development, and which, in certain special cases, coincides with a principle of Schwarz called the principle of symmetry. The author shows how, by certain particularizations of the ideas, a general notion may be obtained of those functions which have linear transformations among themselves; and a theory is then given of single-valued functions of this kind. The author speaks of a Riemann's manifold, instead of a Riemann's surface, and considers a closed two-dimensional manifold instead of a closed surface, and, upon this manifold, single-valued definite differential expressions, instead of simply the element of length. Numerous references are given to the earlier literature of the subject, in which the investigations of Poincaré stand out most prominently. The present memoir, taken with the previous one above referred to, constitutes one of the most important additions that has ever been made to Riemann's theory of functions. — (*Math. annalen*, xxi.) T. C. [413

Functions of two variables. — M. Poincaré gives a generalization of a theorem of Weierstrass concerning functions of one variable. The theorem in question is, "*If $F(x)$ is a meromorphic function over the entire plane, it can be placed in the form of a quotient of two integral functions.*" M. Poincaré seeks to find the analogous theorem in the case of two variables, and considers a function, $F(X,Y)$, of two imaginary variables ($X = x + iy$, $Y = z + it$). Calling u the real part of a function of X and Y, it is seen that u satisfies a differential equation ($\Delta u = 0$) where

$$\Delta = \frac{d^2}{dx^2} + \frac{d^2}{dy^2} + \frac{d^2}{dz^2} + \frac{d^2}{dt^2};$$

u also satisfies certain other partial differential equations of the second order, which need not be written down. Any function satisfying the equation $\Delta u = 0$ is called a potential function. The aggregate of points satisfying the inequality

$$(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2 + (t-t_0)^2 < r^2$$

is called a hyperspheric region. The author constructs an infinite number of hyperspheric regions, and considers a point $(x\,y\,z\,t)$ as belonging to at least one of these regions, and being common to not more than five of them. The final theorem obtained is as follows: if Y is any non-uniform function of X,— which has no essential singular points at a finite distance, and which cannot, for the same value of X, take an infinite number of values infinitely near to each other,—it can be considered as the solution of an equation, $G(X,Y) = 0$, where G is an integral function. — (*Comptes rendus*, Jan. 22.) T. C. [414

PHYSICS.

Mechanics.

Motion of a pendulum. — M. Lipschitz, in a letter to M. Hermite, investigates the motion of a heavy body capable of turning freely about a horizontal axis.

Let M be the mass of body; N, moment of inertia about the axis; Z, distance of centre of gravity of body from the axis; g, acceleration of gravity; θ, angle of rotation, which is 0 when body is at rest. The motion is considered, first, under the condition that the angular velocity vanishes for the value θ_0 of θ, and, secondly, under the condition that the angular velocity vanishes for the value $\pi - \theta_0$ of θ. If t and t′ denote the times in these two cases, then

$$\tfrac{1}{2} N \left(\frac{d\theta}{dt}\right)^2 = ZMg\,(\cos\theta - \cos\theta_0),$$

$$\tfrac{1}{2} N \left(\frac{d\theta}{dt'}\right)^2 = ZMg\,(\cos\theta + \cos\theta_0).$$

M. Lipschitz expresses t and t′ in terms of elliptic integrals of the first species, and proceeds to find the corresponding integrals (w and w′) of the second species. He points out that these represent quantities to which Hamilton gave the name *accumulated living force;* that is to say, in each case the element of the integral is equal to the sum of the living forces of the system multiplied by the element of time. He shows that if T and T′, W and W′, denote the values of t and t′, w and w′, corresponding to the passage of the body from the state of rest (when θ equal 0) to the state when θ is a maximum (which is θ_0 in the first case, and $\pi - \theta_0$ in the second case), then

$$TW' + WT' = 2\pi N.$$

Whence it appears that this expression, involving the four quantities T, T′, W, W′, for the two assumed conditions of motion of the same body, has a value depending solely upon the moment of inertia of the body. — (*Comptes rendus*, Dec. 4, 1882.) G. A. H. [415

Changes in the teaching of mechanics. — M. Yvon Villarceau observes, that what is usually and vaguely termed 'rational mechanics' might with more propriety be called 'general mechanics,' following the example of M. Resal. The science, in M. Villarceau's method of treating it, is based on two principles, — the equation of the motion of a material point projected upon a fixed arbitrary line, and the principle of action and re-action. In treating problems which involve the *liaisons* of points, a certain rule, often neglected, should always be observed. This rule consists in determining the values of all the forces which are eliminated in effecting the solution of the problem, so that we may know whether they are compatible with the properties of the matter of which the bodies are composed; e.g., the intensities of the forces ought not to exceed the limits of the resistance, strings ought not to be subject to a compression, etc. From failure to observe this rule, contradictory results may be reached in the case of certain problems; although all the theorems employed in the solution are incontestably true. As an illustration, M. Villarceau considers the motion of a solid of revolution turning about its axis of symmetry, and left to itself. He is led to the conclusion that the study of the motion of a geometrical solid left to itself ought to be excluded from general mechanics. — (*Comptes rendus*, Dec. 26, 1882.) G. A. H. [416

(*Photography.*)

Quantitative photographic measurements. — In connection with the above article a paper was read by Mr. W. H. Pickering, describing some experiments on the absolute sensitiveness, and other important characteristics, of photographic dry plates. As a standard of sensitiveness, ordinary white filter-paper, which is salted and sensitized in standard solutions, was selected. No toning or fixing is employed after the exposure; and the amount of light absorbed by the exposed portions is measured by a photometer by gaslight. The paper and the plates to be compared are exposed altogether to the direct light of the sky, shining through diaphragms. The plates are then placed in a standard developer for a given time, and fixed. They are next measured by the photometer, and the per cent of light absorbed by the exposed portions determined. The amount of light necessary to darken the paper and each plate 50 per cent is calculated; and the reciprocals of the ratios of these amounts then give the absolute sensitiveness of each plate in terms of the paper taken as a standard. This sensitiveness was found to vary between one and ten million for the various plates measured. It was shown that the plates most sensitive to faint lights were by no means necessarily the most sensitive to high ones, and that those most fogged by gaslight were not proportionately so when exposed to the light of the sky. It was found, that if we expose one portion of a plate to a standard light for a standard time, and then expose another portion to *n* times the light for an *n*th the time, the same result will be obtained. The largest value of *n* employed was 500; but, if the law holds for all values, it can be shown that an average plate exposed to direct sunlight will be darkened perceptibly by an exposure of $\frac{1}{10,000,000}$ part of a second. The relative sensitiveness of the paper and plates may perhaps best be illustrated by the fact that to take a photograph of a landscape under ordinary conditions requires an exposure of about five seconds. Now, to take the landscape under the same conditions on sensitive paper directly would require an exposure of a little over one year of continuous sunlight, day and night. Measurements were made of the amount of contrast obtainable by the different plates, and also of the range of light through which they would give gradations of shading. Great differences were found to exist in them, and several peculiarities in the development of the plates measured were noted. — (*Amer. acad. arts. sc.; meeting* Feb. 14.) [417

Bicarbonate-of-soda developer. — A developer very popular in Europe at present is that recommended by Mr. John McKean, — a cold saturated solution of bicarbonate of soda, 1 ounce; liquid ammonia (.880), 1 ounce; water, 4 ounces.

A few drops of the above in a three-grain solution of pyro. will develop any good plate with less exposure, and with more detail in the shadows, than has ever yet been secured with the use of bromide. If the shadows are not as clear as may be desired, increase the proportion of bicarbonate. One or two drops of nitric acid in the hypo. solution dispel any trace of fog that may exist after a forced development, in the case of under-exposure. — (*Phot. times*, Jan.) W. H. P. [418

Carbonate-of-soda developer. — A very popular recent American developer is that given by Mr. H. J. Newton. Stock solution No. 1: carbonate of soda, 500 grains; water, 10 ounces. Stock solution No. 2: pyrogallic acid, 20 grains; oxalic acid, 30 grains; water, 10 ounces.

Take equal parts of the above solutions, thoroughly mixed, and flow over the exposed plate, which has first been laid in water for a minute or two. If the plate should be over-exposed, add a few grains of bromide of ammonia; if under-exposed, use a stronger solution of soda. Instead of oxalic, we may use glacial phosphoric acid ($1\frac{1}{4}$ grains to the ounce) or concentrated formic acid (4 grains to the ounce). These acids give rather better colored images than the oxalic, but, even in large cities, are sometimes difficult to obtain. — (*Phot. times*, Feb.) W. H. P. [419

Electricity.

Rotatory effect of terrestrial magnetism. — In 1878 H. Becquerel showed that the rotatory influence of terrestrial magnetism on light traversing gases could be accurately measured. The fundamental experiment consists in arranging upon the same horizontal support, movable about a vertical axis, a source of light, a polarizer, a column of the substance to be investigated, and an analyzer mounted upon a divided circle. The axis of the column and of the beam of light is placed in the magnetic meridian, and the plane of polarization noted: the apparatus is then turned end for end; the plane of polarization is still the same, but the divided circle has been turned about, so that the apparent rotation is reversed. The effect was multiplied by successive reflection from mirrors at the end of the column of gas, and also by interposing a thin crystalline plate, which rotated the plane of polarization symmetrically about the axis of the crystal.

The author found that the plane of polarization of the luminous rays, D, is rotated through .9435′ in traversing 1 metre of CS_2 at 0° C. under the influence of terrestrial magnetism, and that between two points 1 cm. distant, in a magnetic field of strength unity (C. G. S.), the rotation of the same rays in passing through CS_2 at 0° C. is .0463± .0004. Thus he claims he can measure, by an optical determination, the intensity of any magnetic field whatever to $\frac{1}{100}$ of its value. — (*Ann. chim. phys.*, Nov., 1882.) J. T. [420

Electric discharge in rarefied air. — Edlund continues his investigation of this subject. He connects the combs of a Holtz machine by means of a wire interrupted by a short air-space. The circuit contains in multiple arc a sensitive galvanometer, and a rarefied-air space, 5 mm. long, between aluminium electrodes. The galvanometer is also shunted by a wire; and one junction of this shunt with the rest of the circuit is grounded. When the Holtz machine is worked, frequent sparks pass, and the galvanometer-needle finally attains a nearly constant deflection. The singular fact is observed, that this deflection is many times greater, when the galvanometer is shunted by the rarefied-air space, than when it is not so shunted. The explanation proposed is, that, after each spark from the Holtz machine passes through the rarefied-air space, a 'disjunction,' or reverse current, is set up by the e. m. f., which the discharge has generated at the surface of the electrodes. This current passes through the galvanometer in the same direction as the current from the machine.

Edlund's articles seem to be of value in calling particular attention to the long-recognized resistance at the surface of the electrodes in a discharge-tube, thus making it appear probable that the proper resistance of rarefied air has been overestimated, and so tending to remove the difficulty at present felt in regard to the height of auroras. Edlund's own conclusion — viz., that empty space, or rather the ether, is an excellent conductor — will probably be accepted by few. — (*Phil. mag.*, Jan.) E. H. H. [421

ENGINEERING.

The Corinth canal. — As early as the year 625 B.C., the idea of connecting the gulfs of Corinth and Aegina by means of a canal was conceived. It was abandoned after some discussion, from the belief that the level of the sea in the gulf of Corinth was higher than that in the gulf of Athens. Later, Julius Caesar, Caligula, and Nero employed engineers to plan this work; but little was actually accomplished. Quite recently Gen. Türr obtained a concession from the Hellenic government to cut a canal across the isthmus, of dimensions sufficient to pass one vessel at a time; the cross-section being the same as that of the Suez Canal, i.e., 72 feet wide at the bottom, and with a depth of 26 feet. Three several routes were surveyed, being respectively 3.94 miles, 4.2 miles, and 6.8 miles in length. The first of these lines was selected, being the same as that proposed by Nero's engineers. The work was commenced last May, the estimated cost being thirty million francs. It is believed that the investment will be a good one, as the traffic across the isthmus is now from five to six million tons annually. — (*Engineering*, Dec. 8, 1882.) G. L. V. [422

The Kinzua viaduct. — This remarkable structure carries a branch of the New-York, Lake-Erie, and Western railroad, over a deep gorge in western Pennsylvania, the Kinzua Creek. This is the highest railroad-bridge in the world, the distance of the rails above the stream being 301 feet, while the whole length of the work is 2,052 feet. The structure is designed to sustain a continuous line of the heaviest locomotive engines from one end to the other, or 2,660 tons in all. The original conception of a viaduct at this place is due to Mr. O. W. Barnes, C. E. The execution has been made under the general direction of Mr. O. Chanute; the details being arranged and the construction carried out by Messrs. Clarke, Reeves, and Co. of Philadelphia. The total cost of this enormous structure was but $237,000, and the time occupied in building was only 94 days. The towers were erected without scaffolding of any kind, while the superstructure was placed in position by means of a travelling crane; a method which secured economy of both time and money. Especial care has been taken to enable the structure to resist the severest gales of wind. Ample provision, too, has been made for the effect of heat and cold upon the iron-work. — (*Engineering*, Dec. 22, 29, 1882.) G. L. V. [423

Centrifugal pumps. — The common objection to this kind of pump is, that it wastes a large percentage of the power applied; but G. Kapp of London maintains, that, if the pump is rightly made and rightly worked, it will utilize as large a percentage of the applied work as any hydraulic machine. He gives the mathematical theory of the centrifugal pump, shows how to find the loss through friction, investigates the best form for the wheel-blades, and lays down general rules for the construction throughout. — (*Civilingenieur*, heft 4, 1882.) G. A. H. [424

CHEMISTRY.

(General, physical, and inorganic.)

Formation of natural manganese binoxide, and certain reactions of other peroxides. — From the results of M. Berthelot, it seems that the heat of formation of $Mn\,O_2$ in the reaction $Mn\,O + O = Mn\,O_2$ is larger by 3.9 cal. than that of $Mn\,C\,O_3$ in the reaction $C\,O_2$ (in solution) $+ Mn\,O = Mn\,C\,O_3$. An explanation is thus found for the formation of the mineral pyrolusite by the action of air, either free, or dissolved in water. In the reactions $2\,Fe\,O + O = Fe_2O_3, + 13.3$ cal. for Fe O; $3\,Fe\,O + O = Fe_3O_4, +$ 10.3 cal. for Fe O; $C\,O_2$ (in solution) $+ Fe\,O = Fe\,C\,O_3$, + 5 cal. (or, $C\,O_2$ (gaseous), + 7.8 cal.), — more heat is evolved in the formation of the oxide than of the carbonate. The stability of $Ba\,C\,O_3$ is shown in the reactions $Ba + O = Ba\,O, + 6$ cal.; $Ba\,O + C\,O_2 = Ba\,C\,O_3, + 28$ cal. Hydrogen peroxide cannot be formed from $Mn\,O_2$, since there would be an absorption of heat: $Mn\,O_2 + H\,Cl = Mn\,Cl_2 + H_2O_2, -9.7$ cal. It cannot be formed from ferric oxide, since the quantity of heat absorbed would equal − 16 cal. With

barium peroxide, heat is evolved: $BaO_2 + 2HCl = BaCl_2 + H_2O_2, + 11$ cal. — (*Comptes rendus*, xcvi. 88.) C. F. M. [425

Electric conductivity of silver chloride, bromide, and iodide. — W. Kohlrausch finds that silver salts of the halogens offer less resistance to an electric current than sulphuric acid. In the order of their conducting-power, the chloride stands first, the iodide last, and the bromide occupies an intermediary position. — (*Ann. chim. phys.*, xxvii. 642.) C. F. M. [426

Antiseptic character of carbonic-dioxide gas. — In an atmosphere of this gas, H. Kolbe finds that the quality of fresh beef can be preserved for several weeks, even in a warm room. Fish, game, mutton, and veal begin to decay after a few days. — (*Journ. Prakt. chem.*, n.f. xlvi. 249.) C. F. M. [427

Investigations on uranium. — For the atomic weight of uranium, the values 120, 180, and 240 have been proposed, the latter appearing in Mendelejeff's classification. In order to decide which of these values is correct, C. Zimmermann determined the vapor density of the tetrabromide and tetrachloride, and the specific gravity and specific heat of the metal. Vapor density of the tetrabromide obtained, 19.46; calculated for UBr_4 ($U = 240$), 19.36: of the tetrachloride obtained, 13.3; calculated for UCl_4 ($U = 240$), 13.21. The metal was prepared by ignition of a mixture of the chloride with sodium covered with salt. Specific gravity, 18.7; atomic volume, 12.84; specific heat of the melted metal, 0.02765. This value multiplied by the atomic weight (240) gives, as the atomic heat, 6.64; the law of Dulong and Petit requiring 6.64. Uranium must therefore occupy a position in the sixth group of the periodic system with chromium, molybdenum, and tungsten. — (*Ann. der chem.*, 216, 1.) C. F. M. [428

Heat of formation of volatile organic bodies. — The heat of formation of such compounds as carbon tetrachloride, chloroform, and perchlorethylen has not been determined, on account of the great difficulty of obtaining complete combustion. In the combustion of compounds of chlorine and carbon containing a small percentage of hydrogen, Julius Thomsen obtains accurate results by burning the volatile substance, mixed with hydrogen, in a special form of apparatus, which he has devised for this purpose. Thomsen concludes from his results, that carbon possesses an equally strong affinity for hydrogen and chlorine. The heat of formation of ethylen and perchlorethylen are nearly the same; and, assuming 14,130 cal. as the most probable value of the double bond between the carbon atoms, the affinity of a hydrogen atom for carbon would be 15,080 cal., and that of a chlorine atom, 14,330 cal. — (*Berichte deutsch. chem. gesellsch.*, xv. 2996.) C. F. M. [429

Constitution of carbonic acid. — Since a solution of carbonic dioxide in water dissolves magnesium with evolution of hydrogen, M. Ballo concludes that it contains the hydrated acid H_2CO_3. As a further proof, he mentions the fact that potassium and sodium bicarbonates dissolve magnesium, forming the carbonate $MgCO_3 . 3H_2O$. The formation of magnesium sulphite, by the action of SO_2 in solution upon the metal, indicates the hydrated acid H_2SO_3. — (*Berichte deutsch. chem. gesellsch.*, xv. 3003.) C. F. M. [430

MINERALOGY.

Jade. — Two specimens, — one from the Karakash valley, southern Turkistan, from a mine formerly worked by the Chinese; the other from New Zealand, — upon analysis, gave C. L. Allen results agreeing with amphibole. — (*Chem. news*, xlvi. 216.) S. L. P. [431

Cryolite. — A review of the history of the fluorine minerals, especially those occurring with cryolite from Greenland, is given by P. Groth along with results of renewed crystallographic and chemical investigation. Crystals of cryolite, after having been identified and measured, were given over for chemical analysis to J. Brandl, whose results agreed very closely with the composition expressed by the formula $3NaF, AlF_3$. The results of the renewed crystallographic measurements prove the mineral to be monoclinic with the axial relation $a : b : c = 0.9662 : 1 : 1.3882$. $\beta = 89° 49'$. The optical deportment of the mineral also indicates its monoclinic character. — (*Zeitschr. kryst.*, vii. 375.) S. L. P. [432

Hörnesite. — Accompanying nagyagite from Nagyag, M. E. Bertrand has identified crystals of a pale rose color, very soft, and easily cleavable in one direction, which, upon chemical examination, proved to be a hydrated arseniate of magnesia containing a little calcium and manganese. The mineral is supposed to be identical with the hörnesite described by Haidinger. — (*Bull. soc. min.*, v. 306.) S. L. P. [433

PHYSICAL GEOGRAPHY.

Former great tides. — Prof. R. S. Ball, in a second lecture on this question, reviews the criticisms of his previous statements, and repeats his belief that the accumulation of the oldest stratified rocks was very probably aided by this newly discovered and very important agent; namely, the stronger tides produced by the moon when not so far from the earth as it now is. — (*Nature*, Dec. 28, 1882.) W. M. D. [434

Gulf-Stream. — Commander Bartlett's recent measures on the coast-survey steamer Blake show that the current off Florida, where the channel is 48 miles wide, and the deepest point 439 fathoms, has a cross-section of 429,526,240 □ feet; a velocity from one to five, averaging three miles an hour; a discharge of 51,000,000,000,000 gallons an hour; and a temperature varying from 78° to 83° at the surface, and from 57° to 44° at the bottom. Farther along our coast, the current flows over an even plateau, narrowing toward Cape Hatteras, about 400 fathoms deep, and suddenly dropping off to over 2,000 fathoms at its eastern edge. In the stronger parts of the stream, the bottom is swept clean, and consists of firm coral rock, hard enough to dent the brass cylinder of the sounding-apparatus. Where fine deposits occur, south of Charleston, they are of pteropod ooze, characteristic of the Caribbean and Gulf of Mexico; farther north, globigerina ooze becomes more common, as it is in the open north Atlantic. The division between these two deposits is considered the boundary of the cold, arctic current which follows down our shore from the north, passing under the Gulf-Stream off Hatteras, where the shallow plateau forces it out. No warm and cold bands or bifurcations were found in the surface-waters till off Hatteras, and no distinct 'cold wall.' Near shore the current was much influenced by winds. A brief description is given of the Siemens deep-sea thermometer, based on the variation of electrical resistance in metals with change of temperature. Measures made with this and with the Miller-Casella thermometer show almost absolute agreement, even at considerable depths. — (*Bull. Amer. geogr. soc.*, 1882, 69. Further account of Bartlett's work may be found in *Proc. U. S. naval inst.*, vii. 1881, 25; viii. 1882, 221.) W. M. D. [435

GEOGRAPHY.

(Europe.)

French census of 1881. — After deducting the number of foreigners temporarily resident in France,

estimated at about 1,000,000, Chervin finds that the population increased with extreme slowness, or even remained stationary, when compared with the enumerations of 1872 and 1876. Departments showing an increase have grown by immigration. Decrease of population is found even in some of the rich and well situated departments, as parts of Normandy; and the same districts show a large percentage (40 or 50) of rejections from the conscripts for recruiting the army. Both these marks of a lack of healthy growth are ascribed to the effects of drunkenness, which is unfortunately prevalent in some of the communes of this region. — (*Comptes rendus soc. géogr. Paris*, 1883, 40.) W. M. D. [436

Geographic work in Spain. — According to a summary by Ferreiro, the geographical and statistical institute of Spain have the past year determined the force of gravity at Madrid, and the latitude and longitude (telegraphic) of Madrid and Bajadoz. The difference of level between the Atlantic and Mediterranean is found to be +0.6625 metre: for more accurate determination of this in the future, automatic temperature, pressure, and wind registers have been established at Alicante, Santander, and Cadiz. — (*Bol. soc. geog. Madrid*, xiii., 1882, 317.) W. M. D. [437

(Atlantic Ocean.)

Cape Verde Islands. — This seldom-visited group was examined by Dr. C. Doelter of Graz in the autumn of 1880. The islands do not consist exclusively of volcanic rocks, but contain also gneiss, mica and clay slates, and limestones, lending support to the view that they make part of a continental mass once of considerable extent. Their former direct connection with the mainland is, however, questionable, as the opposite shore of Africa does not contain similar formations in their latitude. (A connection would seem more probable north-eastward to the Atlas range.) Doelter's geological results are given in Die vulkane der Kapverden und ihre producte (Graz, 1882). This is to be followed by a general narrative including his journey to western Africa, with the title Nach den Kapverden und dem Rio Grande (Leipzig, Frohberg). — (*Peterm. mitth.*, 1883, 72.) W. M. D. [438

Atlantic Soundings. — The brothers Siemens have established a broad reputation by their technical as well as scientific work, ranging from their copper-works in the Caucasus to the construction of cables and telegraph-lines through oceans and wildernesses, as well as to practical researches in electricity. It has not, however, been generally known, that, since 1874, they have undertaken deep soundings in the North Atlantic from one of their own vessels, in connection with their work of cable-laying. Their results have lately been published (Stanford, London) in three charts, giving a valuable addition to our knowledge of the relief of the sea-floor in the cable-zone between Ireland and Newfoundland. The soundings were made with Sir William Thomson's steel wire apparatus, and, by repeated measures in the same place, are found accurate within a few fathoms, even in depths of two miles. The charts are of limited areas; one including the 'Faraday Hills,' N. lat. 49° 20′ to 50°, W. long. 28° 30′ to 30° 15′; the other two, in the region of the Vlämic cape, east of the Newfoundland banks. — (*Peterm. mitth.*, 1883, 39.) W. M. D. [439

The 'Travailleur's' cruise in 1882. — Lieutenant Parfait reports that the Travailleur spent July and August of last summer in following near the coast of Spain and Morocco as far as the Canaries, and back by Madeira to Lisbon and Rochefort. The weather was much worse than was expected; but 71 dredgings were made in depths from 50 to 1,800 fathoms. The 100-fathom plateau was found along the northern coast of Spain, with a width of about twenty miles; beyond its border the depths were very variable, as had been the case in the previous cruises. With this rapid change of depth, the character of the bottom changed also, and the fauna was local. Off Morocco, the bottom was more even, and was covered with a soft reddish mud; the fauna was new and interesting. Among the Canary islands the depths were variable; the bottom was almost barren of life, and was strewn with volcanic dust and ashes. By Madeira, the dredge was often brought up torn by the corals on the bottom. — (*Comptes rendus, soc. géogr. Paris*, 1883, 55, map.) [An account of the outfit and previous soundings of the *Travailleur* is given by Milne-Edwards (*Bull. soc. géogr.*, 1882, 93.)] W. M. D. [440

BOTANY.

Cryptogams.

Marine algae of Germany and Austria. — The first three parts of the second volume of Rabenhorst's Kryptogamen-flora contain an account of the marine algae of Germany and Austria by Hauck, illustrated with numerous and excellent woodcuts, showing the structure of the fronds and fruit of the different genera, and three full-page photolithographs of species of Corallineae. The parts already published include the lower orders of Florideae, from Porphyraceae to Cryptonemiaceae. The descriptions are clear and full, and the synonymy carefully arranged; and the work will be of great value to American algologists, as it gives the best comprehensive account of the European genera of red seaweeds, the greater part of which have representatives on our own coast. — W. G. F. [441

Reproduction in Saprolegniaceae. — The Botanische zeitung contains a reply of DeBary to the remarks of Pringsheim in the Berlin Monatsbericht, in which he questioned the accuracy of some of DeBary's statements in his work, *Beitraege zur morphologie der pilze*, heft 4. DeBary regarded those forms in which ripe spores were produced in oogonia without the intervention of pollinodia (which, in most of the species, make their way into the oogonia) as instances of apogamy, and considered that the forms in question were originally derived from some form having proper pollinodia, but had gradually lost their sexuality. Even in the species of Achlya in which pollinodia are present, DeBary failed to see any direct communication between the contents of the oogonia and pollinodia. Pringsheim, on the other hand, describes bodies which he calls spermamoebae, which are contractile masses of protoplasm formed in the pollinodia, and which may be discharged through the walls of the pollinodia without any apparent opening, and unite at once with the oospheres when the pollinodia are in the oogonium; or, in case they do not reach the oogonia, as in some species of Achlya, the spermamoebae are discharged into the water, and then make their way into the oogonia. In the Botanisches centralblatt, Zopf maintains that Pringsheim's spermamoebae are amoeboid parasites. DeBary believes, that, even on the supposition that the spermamoebae are not parasites, there are species of Achlya and Saprolegnia in which sexuality is entirely wanting, and that one cannot assume, as Pringsheim has done, that, in the forms in which the oospores are produced without any apparent formation of pol-

linodia, a fertilization is accomplished by means of spermamoebae produced from antheridia remote from the oogonia. DeBary again shows that it is not true, as Pringsheim maintains, that the spores produced, as he calls them apogamously, differ from others in the duration of their resting-period. — (*Bot. zeit.*, Jan., 1883.) — W. G. F. [442

Phenogams.

Leafy berries in Mitchella repens. — Monstrous fruits of partridge-berry, from the valley of Cayuga lake, have been studied with attention by Prof. Dudley, who gives several good figures of the malformations. The following statement shows that the cases possess more than ordinary interest: "The true peduncle has entirely disappeared; and those parts of the petioles coming in direct contact with the berry have become part of it, and have readily assumed its color, texture, and general aspect. But this union has not interfered with the fruitfulness or development of the ovary; the seeds being present, and the size of the berry not being under the average." — (*Torrey bot. bull.*, Jan., 1883.) G. L. G. [443

Fertilization of Asclepias cornuti. — The structure and development of the asclepiad flower have been restudied by Mr. T. H. Corry, who stated the result of his work before the Linnean society Dec. 21, 1882. Self-fertilization, with the parts *in situ*, is believed to be impossible. — (*Nature*, Jan. 11, 1883.) W. T. [444

Dichogamy of Pelargonium. — Professor Barnes points out the protandry of the lemon-scented geranium, P. graveolens (*Botan. gazette*, Jan., 1883). In this respect the genus is a very homogeneous one. — W. T. [445

Pollination of Arum italicum. — Dr. Kraus, who has recently studied at Rome the rise of temperature observable in the spathe of this aroid, finds that the maximum is reached between four and six P.M., when it may exceed the temperature of the surrounding air by 27.7° C. At this time the stigmas of the pistillate flowers are receptive, and the spathe opens to allow the entrance of small diptera, which are attracted by the warmth and shelter offered. If they have previously escaped from older spathes, they bring pollen to fertilize the mature pistils. Their escape is prevented by a whorl of rudimentary stamens, as in A. maculatum and some spathes of Arisaema triphyllum. The temperature gradually falls until morning, when each stigma, having wilted, emits a drop of nectar that is greedily eaten by the flies. The stamens now dehisce, and the insects, pollen-laden, escape to visit other young spathes later in the day. — (*Abhandl. naturf. gesellsch. Halle*, xvi.; fide *Kosmos*, Dec. 30.) W. T. [446

ZOÖLOGY.

Polyps.

Operculate corals. — G. Lindström has just issued an important memoir on the operculiferous corals of the paleozoic formations, illustrated with nine fine plates. He divides them into two groups, — Calceolidae and Araeopomatidae; the former containing Calceola, Rhizophyllum, and the recently described Platyphyllum Lindström (upper Silurian of China), — all with opercula of a single valve, — and Goniophyllum, with an opercular apparatus of four pieces. None of the species are new; though Platyphyllum sinense has barely entered into paleontological literature in the fourth volume of Richthofen's 'China.' The second family contains the new genera Areopoma and Rhytidophyllum; the former proposed for Cystiphyllum prismaticum Lindström (1868), from the Silurian of Gotland, and the latter for R. pusillum, a new species from the same formation. A broken operculum from Lerberget, not named, is believed by the author to represent a new genus of the same family. Remarks follow on Pholidophyllum and Syringophyllum. Chelodes Dav. & King, a very problematical genus, is referred to as probably Chitonoid. The text (ninety-four pages) is in Swedish. Twenty-one species are illustrated. — (*Svensk. vet. akad. handl.*, vii. iv., 1882.) W. H. D. [447

Mollusks.

European land-shells. — The first supplement to the second edition of Kobelt's catalogue of the European land and fresh-water mollusk-fauna is just published. It is presented in the shape of a systematic catalogue of species, with synonymes, locality of publication, and habitat, for each of the additions, which are very considerable. Most of the real additions are from the Caucasian region, the borders of the western Mediterranean, Italy, and Sardinia, and are due to Boettger, Kobelt, Paulucci, Lessona, and Pollonera. To Locard and Bourguignat we are indebted for an extraordinary number of new names, applied to variations and varieties of well-known species. The amount and character of the current literature of this topic may be imagined from the fact that this supplement contains about twenty pages of new names supposed to be valid, and five pages of pure synonymes.

In the same issue appears an article by H. Tschapeck, on the varieties of Clausilia dubia found in Steiermark. — (*Nachr. blatt. malac. ges.*, 1883.) W. H. D. [448

Shells from the Colorado region. — Mr. Stearns has recently received from Indio, Colorado desert, a most interesting lot of Physae, collected by Prof. George Davidson. They intergrade perfectly with one another, connecting P. humerosa with P. heterostropha, and these with P. virgata, etc. Recent data also carry the distribution of Anodonta californiensis two hundred and fifty miles east of the main stream of the Colorado river. — W. H. D. [449

Variations of Pompholyx. — A calcareous deposit occurs in Pyramid lake, Nevada, consisting chiefly of incrusted pine-needles and shells of Pompholyx effusa. These last vary widely from the original type, showing all grades of costation from perfectly smooth to strongly costate, as in Vorticifex; these being the form named costata by Hemphill. Others show decided inclination to become umbilicated, thus verging toward Carinifex and its allies. — W. H. D. [450

Worms.

A cave-dwelling Planarian. — Under the provisional name of Vortex cavicolens, Dr. A. S. Packard, jun., describes a Turbellarian from X cave of the Carter caves, Kentucky. The animal is white, about four millimetres in length, and in the alcoholic specimen no eyes could be observed. There is but a single genital outlet near the posterior extremity. — (*Amer. nat.*, xvii. 89.) C. S. M. [451

Hamingia artica, a rare gephyrean. — This rare worm was known only from three specimens. Lankester has now had an opportunity of examining two others, one of which he dredged himself last summer at forty fathoms, on a rocky bottom off Lervik. Lankester's specimen had a proboscis, or frontal hood, which he supposes to have been broken off in Koren and Danielssen's original specimen, as they consider its absence characteristic. In the liquid of the body-cavity exist corpuscles impregnated with

haemaglobin. Lankester's second specimen had only one genital papilla and orifice, instead of two, and contained five males, which live, as in Bonellia, as minute parasites on the female. The male is provided with a pair of large genital setae, although such are wanting in the female. — (*Ann. mag. nat. hist.*, xi. 37.) C. S. M. [452

Myriapods and arachnids.

The blastopore and mesoblast of Peripatus. — The late Prof. Balfour was engaged, just before his death, upon a monograph on the anatomy and development of Peripatus, and left a series of notes, completed manuscripts, and drawings, which it is intended to publish in the Quarterly journal of microscopical science for April next. Some of the results have been presented as a preliminary note to the Royal society of London.

The results are briefly as follows: that a widely-open slit-like blastopore is formed in the early oval embryo. The blastopore, which occupies the median ventral line, becomes closed in its centre, an anterior portion remaining open as a mouth, while a posterior portion apparently becomes the anus. The mesoblast is formed from the entoderm at the lips of the blastopore, and makes its appearance as a series of paired hollow outgrowths from the cavity of the archenteron. — (*Journ. microsc. soc. Lond.*, Feb., 1883, 52.) C. S. M. [453

Eyes of Scorpio and Limulus. — E. Ray Lankester and A. G. Bourne have investigated the minute structure of the eyes in Limulus and Scorpio, and conclude that the results, which are given in detail and with elaborate illustrations, confirm the opinion previously expressed by Lankester, that the scorpions and king-crabs are closely allied representatives of the class Arachnida. The compound lateral eyes of Limulus are compared with the lateral groups of simple eyes in scorpions, and found to agree in the most essential points. The central eyes of Limulus are found to agree still more closely with those of scorpions. — (*Quart. journ. microsc. sc.*, Jan., 1883.) S. I. S. [454

Insects.

The scales of Coleoptera. — Mr. George Dimmock described the scales, or scale-like hairs, of a number of beetles, and considered the effects of scales on the coloration of these insects, and the modes of coloration of scales themselves. Scale-like hairs of Cicindela. Psiloptera, Anthrenus, Hoplia, Polyphylla, Valgus, Chalcolepidius, Alaus, an undetermined genus of European Elateridae, Ptinus, Clytus, and Entimus, were described. This adds the Elateridae and Cerambycidae to the families which were already recorded as sometimes owing their figuration to a scale-covering. The influence of air in producing silvery and milky whiteness in insects and in their scales was also discussed. The author adopted Dr. H. A. Hagen's division of the colors of insects into 'optical' and 'natural' colors of two sorts, — 'dermal' and 'hypodermal,' — and gave a table of treatment with reagents, to enable one to distinguish these colors in scales under the microscope. As far as examined, scales of Lepidoptera owed their coloration to optical and hypodermal colors; scales of Coleoptera, to optical and dermal colors; although too much stress must not be put upon the differences between dermal and hypodermal colors. The paper, which will appear in full in *Psyche*, was illustrated by numerous figures and microscopic preparations. In conclusion, a mode of collecting together scales, or other minute objects of similar nature, on a microscope slide, was exhibited. This consists in putting the scales in a drop of some quickly evaporating substance — chloroform is best for most purposes — on the slide. The scales will form in a kind of whirlpool, nearly all the scales finally settling down, as the liquid evaporates, in one place on the slide. This mode of operating is very convenient; and, by inclining the slide gently, the mass of floating scales can be made to settle on the exact centre of the glass. One part of Canada balsam to several hundred of chloroform will cause them to stick to the slide. — (*Cambr. ent. club; meeting* March 9.) [455

Mimicry of humming-birds by moths. — The striking resemblance in size, form, and movements, of the South-American Macroglossa Titan to humming-birds, which has been noticed by Bates, Fritz Müller, and others, and referred to the similarity in their habits, is believed by Dr. Krause to be a case of protective mimicry; the moths benefiting by their resemblance to the birds, which have few winged enemies. The closeness of the resemblance is supposed also to protect the moths from the humming-birds, which always give chase when they recognize them. To do away with an objection that might be urged from the similar appearance of European Macroglossae, which have no Trochilidae to imitate, it is assumed either that these birds occurred in Europe in late tertiary times, or that the moths are recent importations from the new world. — (*Kosmos*, Nov.) W. T. [456

(Economic entomology.)

The regulative action of birds upon insect oscillations. — The question "Do birds sometimes vary their diet so far as to neglect their more usual food, and take extraordinary numbers of those species of insects, which, for any reason, become superabundant for a time?" is answered by Prof. Forbes in a very conclusive manner. He selected an orchard which had been for some years badly infested by canker-worms; shot a considerable number of birds therein for two successive years (54 birds of 24 species the first year, and 92 birds of 31 species the second year), representing nearly all the kinds seen in the orchard; made full notes of the relative abundance of the species; examined carefully the contents of the stomachs obtained, with reference not only to the presence of canker-worms, but of all other insects as well; and tabulated the results. The summaries on these tables are brought into comparison with those derived from birds of the same species shot in ordinary situations during the same month. Thirty-six species of birds were taken in the infested orchard. 72% of the species, and 60% of the specimens, had eaten canker-worms. 35% of all the food eaten by all the birds was canker-worms. The comparisons made between the food of these birds and that of birds shot in other situations show, that the large proportion of the food which the canker-worms constituted, in one case was compensated by a general diminution of the ratios of all the other kinds of food, and not by a neglect of one or two alone. Hence the birds, in checking the increase of the canker-worm, were not tending to allow an undue increase of any other species of insect. — (*Bull. Ill. state lab.*, No. 6, Dec., 1882.) J. H. C. [457

Corn-root worm. — The eggs of Diabrotica longicornis have been discovered by Prof. Forbes. They are laid in September and October in the ground upon or about the roots of corn, and probably do not hatch until the following May or June. The best means of checking the increase of this insect is, therefore, rotation of crops. — (*Prairie farmer*, Dec. 30, 1882.) J. H. C. [458

VERTEBRATES.

Discovery of the blood-circulation. — From a careful study of the works of Colombo, and a comparison of dates, Tollin concludes that Colombo was not an original discoverer of the pulmonary circulation, but merely appropriated the work of Servetus. — (*Arch. path. anat. phys.*, xci. 1883, 39.) H. N. M. [459

Internal polarization of nerves. — As the result of experiments carried on in Lovén's laboratory, Tigerstedt concludes, that, when the polarizing current is opened, the polarization instantaneously reaches its highest value, and then continuously decreases. The decrease is at first rapid, then falls more and more slowly; so that polarization still remains long after the opening of the polarizing current, and only asymptotically approaches the zero point. — (*Mitth. physiol. lab. Carol. inst. Stockh.*, i., ii., 1882.) H. N. M. [460

Action of the intercostal muscles in breathing. — Lukjanow has made fresh observations on this long-disputed subject. In his experiments, rabbits and dogs were used; the breathing of the former being mainly diaphragmatic, that of the latter chiefly costal. On examination of the intercostal spaces, exposed by removing the skin and the pectoral muscles, he found that the changes in their width during inspiration depended on the thoracic region observed. The upper two or three intercostal spaces were narrowed in inspiration; the lower three or four, widened; the intermediate remained unchanged. The phenomena were the same in forced and in quiet breathing, and essentially alike in rabbit and dog, though more conspicuous in the latter animal. Moreover, during artificial respiration, the same changes in the widths of the various intercostal spaces were observed as in normal breathing. The author concludes, that it is most probable that the view of Henke and Brüche is correct, in accordance with which the intercostal muscles have no proper duties as muscles, but simply form an elastic membrane, enclosing the thorax. Very considerable difficulties oppose the acceptance of this view, and these Lukjanow to some extent recognizes. He concludes by stating that the full explanation of the phenomena observed by him cannot be given until all the respiratory movements of the ribs have been separately investigated. — (*Pflüg. arch.*, xxx. 1883, 82.) H. N. M. [461

Tarsus of birds and dinosaurs. — This paper by Georg Baur forms an important contribution to our knowledge of the resemblances of the tarsus of birds to that of dinosaurs, especially Compsognathus. The tarsus of birds as shown by embryos is composed of a tibiale, fibulare, and a piece representing tarsals 1-5; the latter anchylose with met. 2-4, and the two first with the tibia. Contrary to the observations of Prof. E. S. Morse, the ascending process is held to be a rather late product, but an integral part, of the tibiale. By an extended study of the tarsus among the dinosaurs, he finds the following points of resemblance to birds: 1°. That the tibia and fibula become slim in embryo birds in the same way as in the evolution of dinosaurs. 2°. The similar blending of fibulare and tibiale, and the position of the fibulare under the tibia. 3°. The blending of the first row with the tibia in both cases. 4°. The morphological relations of the ascending process: this is small or absent in early dinosaurs, and is slowly evolved. 5°. The resemblance of the development of the metatarsals in birds to the evolution of the same parts in dinosaurs. 6°. The similar decrease in the number of the toes. — (*Morph. jahrb.*, 1882, 417.) J. A. J. [462

Permian fishes and reptiles from Texas. — Professor E. D. Cope exhibited some specimens of fishes and reptiles from the Permian formation of Texas. One of these was a new species of Crossopterygian fish, which he named Ectosteorhachis ciceronius. It exhibited some important characters of the posterior cranial region. The base of the skull consists of ossified parachordals; and these embrace the chorda dorsalis posteriorly, and are continued for a short distance posteriorly as a tube. Anteriorly the chordal groove is open. He considered the cranial structure to be an excellent illustration of a permanent embryonic type.

The most interesting reptile was a new genus which occupies a place between the Pelycosauria with molar teeth and those with raptorial teeth, but with more resemblance to the former, or Diadectidae. The teeth are placed transversely in the jaws, but the crowns terminate in an incurved apex, without ledge. He named the genus Chilonyx, and referred it provisionally to the Bolosauridae. The typical species is the Bolosaurus rapidens, — an animal with a skull as large as that of a terrapin, and with robust limbs. The surface of the skull is divided by grooves into numerous swollen areas; and some of these on the lateral occipital region are developed to tuberosities, like the rudimental horns of Phrynosoma Douglassi. — (*Acad. nat. sc. Philad.; meeting* March 6.) [463

Reptiles.

Dinodipsas, a new venomous snake. — Professor E. D. Cope drew attention to a recent important discovery, made by Prof. Peters of Berlin, of a new genus of venomous snakes, Dinodipsas. The speaker stated that he regarded the genus as pertaining to the Causidae, — a family he had proposed as a subfamily in his first paper read before the Academy in 1859. As Causus, the only genus heretofore known, is African, the statement of Peters, that Dinodipsas is South American, adds an important fact to geographical zoölogy. Prof. Cope then corrected a statement made by Peters in his herpetology of the *Reise nach Mozambique*, that he (Prof. Cope) had referred Causus to the vipers. In 1859 he had divided the venomous snakes with vertical and hinged maxillary bones into the subdivisions of the rattlesnakes, the vipers, the Atractaspines, and the Causines. He then designated the entire group Viperidae, after Bonaparte, and had not until later used Dumeril and Bibron's terminology. This did not, however, justify Peters in stating that he has referred the genus Causus to the vipers, and that he (Peters) was the author of a separate family, the 'Vipernattern,' to receive that genus and Dinodipsas. — (*Acad. nat. sc. Philad.; meeting* March 5.) [464

Mammals.

On Halichoerus gryphus. — Nehring, basing his remarks upon the result of an examination of a full-grown male gray seal, captured at Goehren, island Rügen, gives some valuable information in regard to the species. The intestines of the Goehren specimen, which measured 38 metres, i.e., 17 times the length of the animal, were filled with partially digested fish-vertebrae, and immense numbers of the nematoid worm, Ascaris osculata. A comparison of skulls in the museums of the universities of Greifswald and Berlin shows that great variation exists; making it probable that the three species of Halichoerus recognized by many zoölogists represent but the variations of a single one. The presence of six molars, either on one or both sides of the upper jaw, in 8 out of 34 skulls examined, is noted, and is regarded as representing a tendency to reversion rather than an abnor-

mality or monstrosity. The general principle is laid down, that the number and form of teeth in mammals are no less subject to modifications than the amount or color of pelage, the length of the ear or tail, or the proportions of the skeleton. The article closes with remarks on the proportions of the skeleton, and the geographical distribution and abundance of the species. The author inclines to doubt the opinion broached to him by Gerstäcker; namely, that the gray seal is the most abundant species in the Baltic. — (*Sitz.-ber. gesell. naturf. fr. Berl.*, 1882, 117.) F. W. T. [465

Mammals as weather-prophets. — Dr. C. C. Abbott showed that the autumnal habits of certain animals that are popularly supposed to be indicative of the character of the coming winter could not be depended upon; although, by the majority of people living in the country, they were considered as sure indications of what the winter would prove to be. Dr. Abbott had kept a careful record, extending over twenty years, regarding the building of winter houses by muskrats, the storing of nuts by squirrels, and other habits of these and other mammals, and had found that the habits referred to, or their omission, in certain autumns, bore no relation to the character of the coming winter. — (*Trenton nat. hist. soc.; meeting* Feb. 13.) [466

ANTHROPOLOGY.

Ethnography of Kordofan. — Dr. Peney, physician-in-chief of eastern Soudan, sends to Dr. Hamy of Paris a description of the inhabitants of Kordofan. The country is held principally by Arab tribes; and even the negroes were converted to Islamism under that great revival which subjected all northern Africa to the faith of the Prophet. The class of fakirs, or revivalists, is very graphically described, and their power over the natives. A custom of allowing the females of the tribe to do just as they please one day in four, exists among the Hassanichs. — J. W. P. [467

The religions of savages. — M. A. Reville is the author of a work upon the religions of peoples non-civilized, published in Paris by Fischbacker. Mr. A. Lang, reviewing this work, criticises the author for relying too much upon older authorities and upon mere compendiums, but gives him credit for seeing the true import of many superstitions of lower races that have no reason for us.—(*Academy*, Jan. 13.) [468

Brains of great men. — Gen. Skobelef, the hero of Plevna, after death was subjected to a rigorous autopsy. The circumference of his head was 57 centimetres; of the skull, 54; antero-posterior diameter, 18 centimetres; transverse, 14. The brain weighed 1,457 grms. The brain of Gambetta is deposited in the laboratory of the school of higher studies, and will be described by M. Mathias Duval of the Society of mutual autopsy, to which M. Gambetta also bebelonged. — J. W. P. [469

Woman among the Kabyles. — The indigenes of Algeria are among the most interesting portions of the human family. As specimens of humanity, as a composite ethnic residuum, as the repository of features in civilization that have long since been wanting among those with whom they originated, the Berbers have attracted a wide attention. The Kabyles are the modern Berber representatives of the ancient Numidians, familiar to classical scholars in the story of Jugurtha. M. Camille Sabatier has passed some time among these people, and gives us the benefit of his experiences. To those coming from an Arab population, the most striking fact in Kabyle life is the liberty of going and coming accorded to females of all ranks, and on all occasions. Although the poor are very miserable, they are not disheartened; and every care is solaced by a gaudy wrapping, or some tawdry jewelry. While the birth of a son is an occasion of rejoicing, the daughter is an evil omen. It is only when she arrives at a marriageable (marketable) age, that the parents awaken to a consciousness of her existence. All the forces of her education combine to render her vigorous, servile, and revengeful, and to banish love from her heart. The rite of marriage and of bride-sale are described in the graphic style of an eye-witness, and the future of the Kabyles briefly foretold. — (*Rev. d'anthrop.*, Jan., 1883.) J. W. P. [470

Mollusks and civilization. — If all the tribes of men were arranged upon the squares of a modern city, so that by walking eastward and westward we could visit the peoples of the whole earth, they could each be so arranged, that, by going northward and southward, the student of special topics might study the phases of his pet pursuit among the various races. Dr. de Rochebrune has chosen this latter method of study, and has taken the word 'mollusk,' or shell, as his talisman. The use of this animal as food, and of its test in art and ornament, has existed among all peoples, ancient and modern. Others have already gone over the ground, — Stearns, Yates, Barber, Wyman, and Martens, for instance; but the author, having enjoyed especial advantages in the museum of the Trocadero, is able to present something new on the subject of ethnographic conchology. The first memoir is upon the mollusks in the graves of lower Peru. The species used for food as well as for ornament are minutely identified. They are twenty-seven in number, and some of them evidently had been brought a great distance. — (*Rev. d'ethnogr.*, No. 6, 1882.) J. W. P. [471

Mound-builders' pipes. — The curator presented for inspection a collection of thirteen of the 'curved-base' mound-builders' pipes just received from that indefatigable explorer and collector, Rev. J. Gass. These pipes were collected the past year from the mounds in Muscatine, Rock Island, and Mercer counties, by Mr. Gass, his brother, and some neighbors; and he has recently acquired full possession of them for the benefit of the academy, with a full description of the mounds, their structure, etc.

One of these pipes is a finely carved stag's-head, representing the antlers bent around the bowl, and carved in relief; another is an eagle, perched, and holding some small animal in its claws; and two others are neatly carved birds. These four are of ash-colored pipestone. Another is a finely sculptured black bear, and is very appropriately cut in a smooth, fine-grained blackstone. The sixth is supposed to represent a fox with the face turned backward, carved in a beautiful bright red catlinite. The seventh, a non-descriptive animal, is also cut in red catlinite, very much spotted.

Two of plain form are composed of plain red catlinite. The other four are made of a light-brown stone, rather small, and of the simplest form.

There is also an 'axe' of the exact usual form of the plano-convex copper axes, so-called, which is also made of the catlinite, or red pipestone, and a small charm of the same material.

This constitutes a very important addition to this already unequalled collection of the relics of the mound-builders, and brings the collection of pipes of this typical form up to the number of fifty-six, including several unfinished specimens, and by far the largest collection of its kind in the world. — (*Davenp. acad. sc.; meeting* Feb. 23.) [472

NOTES AND NEWS.

— The Compendium of the tenth census, which is now being distributed by the interior department, is comprised in two octavo volumes, each of about 900 pages. This is about double the size of the compendium of the ninth census. This great increase is produced in the main by the introduction of more detailed tables, and of subjects which were not taken up by the ninth census, or, if taken up, their statistics were not summarized in the compendium.

The contents of the work before us may be summarized as follows: to the statistics of population, including, as allied topics, occupations, illiteracy, the defective, dependent, and delinquent classes, and mortality, are given about 800 pages. These include the statistics of the aggregate population, of race and nativity, by states, counties, and minor civil divisions; a classification of the native population by state of birth, and of the foreign element by country of birth; and the statistics of sex and age. The latter are very full, comprising, among others, a table giving the number in each state of each successive year of age.

This matter is followed by the statistics of agriculture, which occupy about 275 pages. These comprise, in general terms, the area and size of farms, extent of cultivated land, and the vegetable and live-stock productions. They are given by states and counties.

The statistics of manufactures, which follow, occupy about the same number of pages as those of agriculture. These are particularly full and complete, containing, besides tables of general statistics by states and counties, the statistics of no less than 332 different industries. Tables of power used in manufactures, a subject new to the census, follow. The statistics of mineral production, petroleum, and of quarries, succeed; then those of railroads, steam-craft, canals, telegraphs, and telephones. Statistics of occupation are sandwiched in between the last and those of fisheries. Then follow foreign parentage, areas, families, and dwellings; Alaskan statistics; fire, life, and marine insurance; wealth, debt, and taxation; illiteracy and public schools; the defective, dependent, and delinquent classes; and, as a fitting *finale*, mortality.

As will be noticed, the arrangement of the work is not all that could be desired. While the great bulk of the statistics regarding the population are grouped in the earlier part of the work, a number of subjects closely related to it are scattered in toward the end. It is very probable that this was a necessity, growing out of the order, in time, in which the different subjects were prepared for publication.

As this work contains abstracts of all the statistical matter of the census, its completion presupposes that of the more extended tables, which form the statistical matter of the full reports; and their appearance may be expected as rapidly as the capacity of the Government printing-office will permit.

— The third meeting of German geographers will be held at Frankfort-on-the-Main on the 29th, 30th, and 31st of this month. As at the previous meetings at Berlin and Halle, the morning sessions will be given up to scientific addresses, and the afternoons to questions of school method. There will also be an exhibition of geographic teaching-material, to remain open for two or three weeks.

— As the city of Buenos Aires was separated from the province of the same name in December, 1880, and made federal territory, it has been decided to establish a new city for the provincial capital, to be called La Plata. Its first foundations were laid Dec. 9, 1882, about twenty-five miles east of Buenos Aires, and three miles west of the harbor of Ensenada.

— Professor Owen, in the Proceedings of the Zoölogical society of London for 1882 (p. 571), objects to the current statement that Hilton was the first to discover the Trichina spiralis, and points out that Hilton saw only the calcified cysts in the muscles of cadavers. To Professor Owen himself properly belongs the honor of the important discovery of the parasitic worm, — a discovery which has led to the prevention of so much suffering by having guided us to the means of avoiding trichinosis.

— For the past five years the Department of agriculture has been endeavoring to encourage the production of raw silk in the United States by the dissemination of eggs, and by publishing for free distribution a manual of instruction. A definite impulse to the industry was looked forward to, when the tariff commission recommended that a small duty be placed upon reeled silk and cocoons; but this recommendation was unheeded by the Senate committee having the bill in charge. A most interesting discussion was brought out, however, by the amendment offered by Senator Morgan of Alabama, Feb. 8, to strike out those articles from the free-list, and to place a duty of ten per cent *ad valorem* upon them. Senator Morgan defended his amendment in a very able manner, and was seconded by Senator George of Mississippi. The amendment was defeated by a vote of 39 yeas to 7 nays. Strangely enough, the two principal arguments were diametrically opposed to each other. Senator Hawley of Connecticut stated that the production of silk had been attempted in this country, at intervals, for two hundred years without success, and held that it could not succeed with all the protection the government could give it; while Senator Ingalls of Kansas pictured in glowing colors the success attained by M. de Boissière at Silkville, Kan., and argued, that, while such results are possible without an import-duty, the necessity for levying such a tax does not exist. As a commentary on this latter argument, we may state that Boissière's silk-experiment is now, and has been for some years,

at a stand-still, solely because stock-raising and general farming have proved more profitable as an investment.

The report of the entomologist of the department, recently issued, confirms all that has been hitherto said as to the adaptability of our country to this industry, and as to the value of the osage orange (Maclura aurantiaca) as silk-worm food. But while there can be no question on these points, or as to the desirability of permanently establishing so important an industry, he has felt it necessary to dissuade rather than encourage large enterprise in this direction, for the simple reason, that, under existing conditions, the investors must needs meet with disappointment. He remarks, "Those who have eggs for sale, or who are interested in the propagation and sale of mulberry-cuttings, and those who are influenced by philanthropic or benevolent motives, can afford, albeit from opposite motives, to stimulate in every possible way the interest naturally felt in the subject; but the disappointment, under existing circumstances, is apt to be great in proportion as the interest increases, so that there is danger of a repetition of the many reactions from similar attempts in the past. This follows necessarily from the fact that the reeled silk is imported free of duty, while there is so very heavy a duty on the woven goods.

"There is a duty to-day, on wools valued at 32 cents, of 10 to 11 cents per pound, and 10 per cent *ad valorem*. Still, in past years, as in 1846, wool has been imported free of duty. Now, wool is essentially a raw product, having gone through no expensive process of manufacture; yet what would our wool-growers throughout the country say, if it were proposed to do away with the duty, and allow wool to come in, as reeled silk is now allowed to come in, free? They would, no doubt, declare that such action on the part of Congress would give the death-blow to wool-growing in the United States. Silk-culture is in just the condition that wool-growing would be in under such circumstances; and if there is any advantage to the country in the protection of one kind of silk-manufacture, then, logically, that other branch of silk-manufacture, namely, silk-reeling, which would add value to the cocoon, and give encouragement to its production, should also be protected."

He remarks that the 'raw silk' now imported, to the value of over twelve million dollars, is a manufactured article, requiring unusual skill and intricate machinery, and that its introduction free of duty is as much an encouragement to foreign manufacturers as the removal of the duty would be on the woven goods.

— The January number of The Virginias, the excellent mining journal edited by Major Hotchkiss, and devoted to the industrial development of the two Virginias, contains a rough map of the Cabin creek coal company's lands, lying south of the Kanawha valley, with sections and borings, in illustration of two reports upon the coal and timber lands of the company by Prof. S. P. Sharples and Capt. I. A. Welch, which are printed in full. The same number contains a reprint of Hitchcock's paper before the mining-engineers in 1882, on the Crystalline rocks of Virginia compared with those of New England, and Notes on the geology of the Virginias from the note-books of the Virginia geological survey of 1835–41, by the late Prof. W. B. Rogers, toward whom Major Hotchkiss stands as literary executor so far as his Virginia work is concerned. It also contains, from the same papers, a geological section of the Ohio river hills at Wheeling, now mostly buried under heaps of slag and cinder, and a careful analysis of the same by Prof. I. C. White. We trust the people of Virginia appreciate Major Hotchkiss's work.

— The officers of the Paris anthropological society for the present year are: president, Dr. Proust; vice-presidents, Dr. Hamy and Dr. Dureau; general secretary, Dr. Topinard; assistant, M. Girard de Recille; annual secretaries, Dr. Prat and M. Issaurat; committee on publication, M. de Quatrefages and Dr. Parrot; curator of the museum, Dr. Collineau; treasurer, M. Leguay; librarian, M. Vinson.

The school of anthropology was opened on Nov. 4, 1882, with the following courses: — *zoölogical anthropology*, M. Mathias Duval, on anthropology and embryology compared, Darwinism, cerebral convolutions; — *general anthropology*, Dr. Topinard, on the history of anthropology, observations and measurements to be made upon the living by travellers; — *ethnology*, M. Dally, description of races, geographical distribution, crossing, degeneration, affiliations, evolution; — *prehistoric anthropology*, M. de Mortillet, protohistory, religion from an ethnic point of view, development of arts, and the origin of agriculture and industry; — *medical geography*, M. Bordier, influence of social environment upon the progress and spread of diseases; — *demography*, M. Bertillon, statistics of marriage, births, and deaths in the different countries of Europe.

— Rev. Henry C. McCook of Philadelphia is engaged upon an illustrated book on 'American spiders and their spinning work,' and hopes to have a volume on the 'Industry and habits of orbweavers' ready by midsummer.

— The Manitoba historical and scientific society has published as its 'Transaction No. 3' a paper by J. Hoyes Panton, late of the Ontario agricultural college, on the Geology of the Red-river valley, in which the author looks forward to the time when the city of Winnipeg will become dependent, for its water-supply, upon the Lake of the Woods, seventy miles distant.

— The curator of the Peabody academy of science, of Salem, reports that winter classes in botany, aver aging more than fifteen regular attendants for the

last four years, and increasing rapidly, have been formed. A newly discovered shell-heap in Ipswich has been opened, and every specimen of value saved; giving the only single shell-heap contents, as yet systematically preserved, from this county. In the early spring some 75 hardy western catalpa-trees, from five to eight feet high, were distributed gratuitously to persons in the county who would give the tree a fair trial, and report results.

— The meteorological bureau of Ohio proposes to establish a system of weather-signals to be displayed on railway trains, making use, of course, of the predictions furnished by the U. S. signal service. Arrangements have already been made with one road leading out of Columbus; and a system of signalling will be put in operation as soon as the best form of signals can be determined upon.

— The chief publications on natural science issued in Bengal the past year were catechisms of sanitation and hygiene for use in the schools in Bengal, and text-books of algebra, arithmetic, and physical geography. Baboo Kási Charan Gupta published the first volume of a Bengalese translation of an English work upon surgery.

— The lecture of Major J. W. Powell, upon Indian mythology, which was announced in the programme of the Washington Saturday scientific course for the 10th inst., was not delivered, owing to the illness of the lecturer. Mr. G. K. Gilbert, who acted as substitute, spoke upon the Ancient lakes of the Great Basin.

— Geographers and meteorologists will regret to learn that the bill making appropriations for the Signal-service of the U. S. army, which passed the last Congress, requires the parties at Point Barrow and Lady Franklin Bay to be recalled, if possible, from the field. It appears that the bill would have been mandatory were it not for the doubt as to whether Lady Franklin Bay can be reached next summer; and, in any case, we may expect the Point Barrow party to be withdrawn. An attempt will be made, however, to utilize the relief expedition to the last locality, by observations with the pendulum, etc., during the stay of the vessel. It is to be hoped, at least, that the observations will not be interrupted before the end of September; since several of the international parties did not get well at work before that time in 1882, and the observations for one co-operative year will not be complete if any of the parties are interrupted in their work at an earlier date in 1883.

— The report of the Board of commissioners of the Second geological survey of Pennsylvania to the legislature, Jan. 1, 1883, contains a colored map showing the progress of the survey up to Dec. 31, 1882. There remains unsurveyed a large part of Huntingdon and Centre counties, a small part of Clinton, and parts of Schuylkill, Carbon, Berks, Bucks, Montgomery, and Clearfield counties. In the anthracite region a number of underground maps have been prepared. Twenty such are finished, and with them a number of accompanying sections. The appropriation for the anthracite work is not sufficient; and they estimate the cost of completing it at $50,000, and the time necessary at three years.

The Chester and Delaware county reports (C 4 and 5), the Warren county report (I 4), and the Lehigh and Northampton report (D 3), will be issued shortly, as soon as the rest of the illustrations are printed.

It is to be hoped that the legislature will provide the necessary funds for the completion of the valuable work of this survey, and that a general index will be prepared, rendering the work of the survey more accessible than it is at present, owing to the large number of volumes, and the somewhat imperfect tables of contents or indexes attached to each volume. We also hope for some contributions from the survey to American paleontology, in addition to Lesquereux's memoirs on the fossil floras, and are sorry to see no mention of any such work.

— At a meeting of the Ohio state forestry association, March 10, it was decided to call a general state convention in the interests of forestry, to be held in Cincinnati, April 26 and 27. Communications, both scientific and practical, are solicited by the secretary, Adolph Leué, Camp Washington, Cincinnati, O.

— The census office has recently published a bulletin concerning the timber resources of West Virginia (No. 25 of the Forestry series). The forests consist chiefly of broad-leaved trees, the narrow-leaved trees (white pine and spruce) being confined chiefly to the higher mountains. The white pine covers about 310 square miles, which are estimated to contain 990,000,000 feet of merchantable lumber. The broad-leaved forests consist in the main of white and chestnut oaks, black walnut (which is wide-spread, but most abundant in the south-west), yellow poplar, and cherry (which is abundant in Greenbriar, Nicholas, and Webster counties, and the country adjoining them).

The lumber product of the state during the census year was valued at $2,431,857. Along the Ohio and its principal branches, especially in the north-western part of the state, all the valuable timber has been cut.

The bulletin is accompanied by a map, showing, in colors, the different classes of forests, and the area from which the valuable timber has been removed.

— Mr. James C. Pilling, of the Bureau of ethnology at Washington, has published in a separate pamphlet his Catalogue of linguistic manuscripts in the library of the Bureau of ethnology, which first appeared in Major Powell's first annual report. The vocabularies of Schoolcraft, Gibbs, Gallatin, Hale, and the Smithsonian institution, have been used for many years in gathering Indian linguistic material. Some of these have been published; others had been

lying in the archives of the Smithsonian, until Major Powell, in 1876, received them to be "consolidated and published in connection with like material collected by himself and his assistants while among the Indians in the western portion of the United States." A succinct account of the work accomplished by the bureau completes Mr. Pilling's introduction. Major Powell has issued a more elaborate Introduction to the study of Indian languages than the instructions of his predecessors, of which the analysis will be found at the close of Mr. Pilling's preface. Besides those printed in former volumes, over three hundred manuscripts of various extent, from thick tomes down to a few pages, remain to be elaborated, and put in print. Mr. Pilling has in type, as far as the letter M, an exhaustive bibliography of North-American Indian linguistics, bringing the subject down to the hour of going to press. He goes to San Francisco this month to consult the Bancroft library.

— Rogozinski and his party, including a geologist, meteorologist, engineer, and mechanic (all Poles), sailed from Havre Dec. 13, 1882, for Fernando-Po, on his African expedition.

— The proceedings of the Belfast nat. hist. and phil. soc., for 1881–82, contain, among other articles, papers by J. J. Murphy on the rainy or post-glacial period, and by Professor Cunningham, on corals and coral islands. The former claims, that, as the astronomical causes which produced the snowy or glacial climate faded away, the rainfall remained heavy for a time, as is shown by the deposits in the bogs of Norway, and the shore terraces of our extinct western lakes. It is supposed that the glacial time was preceded by similar rainy conditions, but their record is lost. The latter gives a general review of the question, and calls attention to Murray's view, that subsidence is not necessary to explain any of the characteristic features of barrier reefs or atolls. They might equally well be produced in regions of rest, or slow elevation as well as depression. The atoll form is taken because the chief supply of food for the coral polyps is on the outer margin, and the rock is carried away from the interior by solution.

— Dr. Cohn of Vienna describes two manuscripts of Dioscorides, on parchment, now in the imperial library at Vienna, which date from the latter half or the fifth century, and are still, for the most part, well preserved. One is known as the Codex Constantinopolitanus, the other as the Codex Neapolitanus; the former having been made for a grand-daughter of Emperor Valentianus III. at Constantinople, afterwards coming into the possession of the Turks, and in 1570 purchased for the imperial library, from the family of a former physician to Sultan Soleiman, for a hundred ducats. It consists of about four hundred folio leaves of fine vellum between worm-eaten wooden covers, with illuminated title, dedication, and other prefatory pictures, followed by the botanical figures and text. Two opposite pages are given to each plant, — on one side the drawing, with the name and synonyms; and on the other, the description in cursive character, without spacing, punctuation, or accent, together with various citations in Arabic, Greek, and Hebrew. The paintings in both codices are evidently copies from the same originals; and though somewhat conventional, and more or less incorrect or imperfect as to details, yet the general and often the specific characters of the plants are preserved in a remarkable degree.

Under the Empress Maria Theresa, and at the instigation of Gerard van Swieten, court physician and librarian, the figures of the Codex Constantinopolitanus were carefully engraved upon copper; but only two impressions are known to have been taken. One of these was sent by order of the empress to Linné, and is now in the possession of the Linnean society of London, in an imperfect condition. The second was given by Joseph Jacquin (or only loaned, as afterward was claimed by Jacquin the younger) to Sibthorpe, from whom it passed by bequest, with the rest of his library and collections, to the University of Oxford, which still holds it.

— The eleventh annual report of the curator of the Museum of Wesleyan university, Middletown, Conn., records some noteworthy accessions to the museum, particularly of Australian marsupials, and of the Sheldon collection of minerals. Attention is called to the fact, that this includes several specimens of the rare mineral samarskite from Portland, Conn. "This mineral, first discovered in the Urals, afterwards found to occur more abundantly in North Carolina, has never hitherto, to the writer's knowledge, been reported from this vicinity."

— At a meeting of the Philosophical society of Washington, March 10, a paper by Mr. M. H. Doolittle, on Substance, matter, motion, and force, elicited an animated discussion. He was followed by Mr. E. B. Elliott, who developed a new formula for the computation of the position of Easter in any year, past or future.

— Rev. E. E. Hale of Boston invites the editor to introduce his wonderful friend, Col. Ingham, to the readers of SCIENCE. In that fabled city of Sybaris, Col. Ingham observed in 1859 a similar contrivance to that mentioned in our summary, paragraph 102. Let us quote him: —

"I sat quite in the front of the car, so that I could see the fate of my first friend, Πλήρες, — the full car. In a very few minutes it switched off from our track, leaving us still to pick up our complement; and then I saw that it dropped its mules, and was attached, on a side-track, to an endless chain, which took it along at a much greater rapidity, so that it was soon out of sight. I addressed my next neighbor on the subject, in Greek which would have made my fortune in those old days of the pea-green settees. But he did not seem to make much of that, but, in sufficiently good Italian, told me, that, as soon as we were full, we

should be attached in the same way to the chain, which was driven by stationary engines five or six stadia apart; and so, indeed, it proved. We picked up one or two market-women, a young artist or two, and a little boy. When the child got in, there was a nod and smile on people's faces. My next neighbor said to me, Πλήρες, as if with an air of relief; and, sure enough, in a minute more we were flying along at a 2.20 pace, with neither mule nor engine in sight, stopping about once a mile to drop passengers, if there was need, and evidently approaching Sybaris." — (*Sybaris and other homes*, pp. 32, 33.)

RECENT BOOKS AND PAMPHLETS.

Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.

Adam, Lucien. Du genre dans les diverses langues. Paris, *Maisonneuve*, 1883. 36 p. 8°.

Bertrand, O. Guide des trois musées du Jardin des plantes. Paris, *Bandot*, 1883. 96 p. 18°.

Cardot, J. Muscinées du département de la Meuse, catalogue des mousses et des hépatiques récoltées aux environs de Stenay et de Montmédy. Montmédy, *imp. Pierrot*, 1883. 42 p. 8°.

Chopy, S., et **Dampierre**, E. de. De la reconstitution des vignobles de la Saintonge à l'aide des plants américains, traitant du greffage du plant américain sur la vigne française phylloxérée. Paris, *Marchal, etc.*, 1883. 28 p. 8°.

Clerke, D. The theory of the gas engine. N.Y., 1883. 160 p. 12°.

Curtis, M. M. The cause of variation. Marshall, Minn., *Author*, 1882. 115 p. 8°.

Dorlhac, J., et **Amiot**. Géologie des bassins houillers de Brioude, de Brassac et de Langeac. Paris, *imp. Quantin*, 1883. 323 p. 4°. 19 pl. f°.

Dubois, A. Histoire naturelle vulgarisée; ornithologie populaire. 4 tom. Limoges, *Barbou*, 1883. 124, 124, 125, 60 p. 12°.

—— La science populaire. Dans les bois, notions populaires d'histoire naturelle. Limoges, *Ardant*, 1883. 304 p. 8°.

Du Moncel, Theodore. Electro-magnets; the determination of the elements of their construction; transl. from 2d ed. N.Y., *Van Nostrand*, 1883. 122 p. 24°.

Echo (l') des inventeurs, journal mensuel illustré, scientifique, littéraire et politique. 1. ann. no. 1. Marseille, *imp. Blanc*, 1er janv., 1883. 4 p., carte. sm. f°.

Fabre, J. H. Nouveaux souvenirs entomologiques: Études sur l'instinct et les moeurs des insectes. Paris, *Delagrave*, 1883. 359 p. 18°.

Fennel, Otto. Die Wagner-Fennel'schen tachymeter der mathematisch-mechanischen instituts von O. F. in Cassel. Cassel, *Freyschmidt*, 1882. 43 p., 7 pl. 8°.

Foëx, Gustave, et **Viala**, Pierre. Ampélographie américaine. Album des raisins américains des variétés les plus intéressantes cultivées à l'école nationale d'agriculture de Montpellier, photographiés d'après nature par M. S. Isard; 80 à 90 planches phototypiques, accompagnées d'un texte descriptif des cépages et d'une introduction à l'étude de la vigne américaine. Livr. 1. Montpellier, *Grollier*, 1883. 2 p., 2 pl. f°.

Fouque, F., et **Lévy**, A. M. Introduction à l'étude des roches éruptives françaises; minéralogie micrographique (Mém. expl. carte géol. France). Paris, *imp. Quantin*, 1883. 6+516 p., illustr. 4°; atlas, 55 pl. 4°.

Gilder, William H. Ice-pack and tundra; an account of the search for the Jeannette and a sledge journey through Siberia. N.Y., *Scribner*, 1883. 10+344 p., illustr., maps. 8°.

Girard, Jules. La Nouvelle-Guinée; historique de la découverte, description géographique, la race papoue, moeurs et coutumes des indigènes, produits du sol, colonisation. Paris, *imp. Levé*, 1883. 55 p. 8°.

Glazebrook, R. T. Physical optics. London, 1883. 448 p. 8°.

Gruey, L. J. Le Stréphoscope universel. Paris, *Chaix*, 1883. 32 p., illustr. 8°.

Harrington, M. W. Report on the mortuary experience of the Michigan mutual life insurance company, from its organization [in 1870] to Jan., 1882. Detroit, *Company*, 1883. 27 p., pl. 8°.

Houghton Farm experiment department. Agricultural physics, 1882. Series 1. nos. 1 and 2. Meteorology and soil temperatures, by D. P. Penhallow. Newburgh, *Ritchie & Hull, pr.*, [1883]. 57 p., 5 pl. 8°.

In memory of William Barton Rogers, late president of the society. Boston, *Society of arts*, 1882. 39 p., portr. 8°.

Iowa weather service annual, 1883. Iowa City, *Central Station*, 1883. 44 p., illustr. 8°.

Jeffries, Benjamin Joy. Color-blindness; its dangers and its detection. *Rev. and enl. ed.* Boston, *Houghton, Mifflin, & Co.*, 1883. 18+334 p. 12°.

Kleinenberg, N. Carlo Darwin e l'opera sua. Messina, 1882. 31 p. 16°.

Langlebert, J. Applications modernes de l'électricité; nouvelles machines magnéto-électriques et dynamo-électriques; éclairage électrique; telephone etc. Paris, 1883. 106 p., illustr. 12°.

Lommel, Th. G. Examen critique des nouveaux essais de tracé entrepris sous les auspices de la Compagnie Suisse Occidentale-Simplon pour la rampe d'accès méridionale du tunnel alpin du Simplon. Lausanne, 1883. 73 p., carte, tracé. l. 8°.

Luke, A. Sammlung trigonometrischer aufgaben nebst eine anleitung zur lösung derselben. Heft 1: Goniometrische aufgaben. Halle, 1883. 8°.

Lyman, Benjamin Smith. On the utility of the Pennsylvania state geological survey in the anthracite field. Read [by title] before the American institute of mining engineers, Feb. 23, 1883. *n.p.*, *n.d.* 8 p. 8°.

Menant, J. Empreintes de cachets Assyro-Chaldéens relevés au Musée britannique sur des contrats d'intérêt prive. Paris, *Maisonneuve*, 1883. 51 p., illustr. 8°.

Métallurgiste (Le), organe des chambres syndicales ouvrières, de la métallurgie. 1. ann. no. 1. Lille, *imp. Ragache*, 17 Dec., 1882. 4 p. sm. f°.

Montreal. — McGill university. Report on the Peter Redpath museum. No. ii. [Montreal], 1883. 22 p. 8°.

Morris, Herbert W. The celestial symbol interpreted; or the natural wonders and spiritual teachings of the sun, as revealed by the triumphs of modern science. Phil., *McCurdy*, 1883. 704 p. 8°.

Natura. Maandschrift voor Natuurwetenschappen. Jaarg. 1., Gent, 1883. 8°.

Penn. — Second geological survey. Report of the board of commissioners to the legislature, Jan. 1, 1883. *n.p.*, *n.d.* 7 p., map. 8°.

Pisani, F., et **Dervell**, P. La chimie du laboratoire. Paris, *Baillière*, 1883. 402 p. 18°.

Poulsen, V. A. Microchemie végétale, guide pour les recherches phyto-histologiques, à l'usage des étudiants; trad. par J. P. Lachman. *Ed. franç.* considérablement augmentée (en collaboration avec l'auteur). (Bibl. biol. intern.) Paris, *Doin*, 1883. 20+119 p. 18°.

Révoil, B. H. A travers les prairies; les peaux-rouges de l'Amérique du Nord; excursions, chasses, etc. Limoges, *Ardant*, 1883. 304 p. 8°.

—— Au pôle et sous les tropiques, histoires recueillies par un voyageur autour du monde. Limoges, *Barbou*. 288 p. 8°.

—— Voyage autour du monde, histoire recueillies par un voyageur. Limoges, *Barbou*, 1883. 144 p. 8°.

Schröter, C. Die flora der eiszeit. Zürich, *Wurster*, 1882. 41 p., pl. 4°.

Scudder, Samuel H. The pine moth of Nantucket, Retinia frustrana. (Publ. Mass. soc. prom. agric.) Boston, *Williams*, 1883. 22 p., pl. 8°.

Smith, J. Alden. Report on the development of the mineral, metallurgical, agricultural, pastoral, and other resources of Colorado for the years 1881 and 1882. Denver, *Chain & Hardy*, 1883. 159 p. 8°.

Southarck, Albert P. Question book of zoölogy with notes, queries, etc. Syracuse, *Bardeau*, 1883. 40 p. 16°.

—— *The same* of chemistry. 37 p.

—— *The same* of geology and mineralogy. 36 p.

Teissier, François. Les merveilles et les mystères de l'océan, ou Voyage sous-marin de Southampton au Cap Horn. Limoges, *Ardant*, 1883. 240 p. 8°.

Vilmorin-Andrieux. Les plantes potagères; description et culture des principaux légumes des climats tempérés. Paris, *imp. Motteroz*, 1883. 16+652 p. 8°.

Woelmont, A. de. Souvenir du Far-West. Paris, *Plon*, 1883. 275 p. 18°.

Wrangell, *amiral de*. Le nord de la Sibérie, voyage parmi les peuplades de la Russie asiatique et dans la mer glaciale; trad. par le prince E. Galitzin. Limoges, *Ardant*, 1883. 304 p. 8°.

Williams, W. Matthieu. Discussions in current science. N.Y., *Fitzgerald*, 1883. 48 p., illustr. 8°.

PUBLISHER'S DEPARTMENT.

JOHN MILHAU.

A TIME-HONORED PHARMACIST.

A BUSINESS ESTABLISHED NEARLY THREE-QUARTERS OF A CENTURY, CARRIED ON IN THE SAME LOCATION FOR OVER HALF A CENTURY, STILL CONDUCTED AS ONE OF THE MOST HONORABLE PHARMACIES IN NEW-YORK CITY.

A BRIEF SKETCH OF THE NOTABLE ESTABLISHMENT OF JOHN MILHAU'S SON, AT NO. 183 BROADWAY, NEW YORK, AND ITS CONNECTION WITH THE ANNALS OF PHARMACY IN THE UNITED STATES.

SEVENTY years ago a young man sixteen years of age was appointed by the French Government consul-general of France for Baltimore; but, having adopted the United States as his country, he declined the honor, which had come wholly unsolicited. It was just at the trying time of the war of 1812; and the young man, having been bereft of his father, was compelled to withdraw from college and to go into business, establishing himself as a pharmacist. Such is the early history of John Milhau, whose name has been indelibly recorded in the annals of pharmacy in New York; for the business which he began in 1818, and carefully supervised until 1869, is still carried on at the same location where it has been for the past fifty-three years, by his son, Edward L. Milhau, under the name of John Milhau's Son. And, through all the vicissitudes in trade during the last seventy years, this house has maintained its position in the front rank in its line, and has met every business obligation in full.

The history of such a house must necessarily be interesting, and especially so, since it has always been identified with the progress of pharmaceutical science, and was the first to introduce many important improvements.

For instance: going abroad to complete his studies in medicine, John Milhau, grasping the possibilities of a new discovery, seized the opportunity to introduce into the United States *quinine*, the first half-ounce of which cost him the then enormous sum of twenty dollars. He was for years the sole agent for the discoverers and manufacturers of this alkaloid; the transactions, after it became adopted by the medical profession, being quite extensive.

John Milhau was not only careful about the details of his own establishment, but during his whole lifetime he was ever prominent in all movements towards the elevation of his profession. He was one of the original incorporators of the New-York College of Pharmacy, in 1830.

He was the head and front of the movement to obtain the law passed by Congress in 1848, prohibiting the importation of inferior, spurious, and adulterated drugs into the United States. He bore the whole brunt of the abuse and threatened lawsuits of the opposition. And there probably existed no one who could better have enlisted the unqualified support of the honorable part of the community, including his colleagues, the members of the liberal professions, and scientists everywhere.

It was in furtherance of his plans to sustain this law, that the New-York College of Pharmacy, of which he was president for many years, called for a convention of delegates from the colleges of Boston and Philadelphia, which resulted in the present American Pharmaceutical Association, the first article of whose constitution declares "for the prevention of the importation of inferior, adulterated, or deteriorated drugs," and the twenty-fourth volume of whose proceedings has as a frontispiece a steel engraving of the intelligent, dignified, and genial countenance of John Milhau, who had served the association as an active member for twenty years, and for a time as its president.

In 1830 he moved into the building, ever since occupied by the firm, now known as No. 183 Broadway. And in the erection of this building, which is the property of his family, he showed his ability and foresight. Here he laid a marble floor,—the slabs of which are pretty well worn through,—which, now so common in places of business, was the first of its kind put down in any but a public building. In 1848 he got Bogardus to make for him the five-story iron front of the present store, which, to the astonishment of thousands, was erected in just three days. The iron front built by Bogardus consisted, not of iron plates riveted to supports, but of very heavy hollow iron castings, securely fastened together by strong screw-bolts, the surfaces that were in apposition being planed so as to fit perfectly true and tight. In spite of every prognostication, this front, which was the first of its kind erected, has stood every test. The incandescent electric light is used for illuminating the premises. And thus do the annals of the old pharmaceutical house illustrate several epochs or changes in various arts and sciences.

But the extreme precaution shown in every detail, by this house, for the welfare of its patrons, is worthy of emulation. To do things right, it is necessary to begin with a proper foundation. For the sake of principles, the firm does not handle what is common to most establishments of its class, and generally regarded as one of the most profitable departments; that is, no wines, liquors, or cigars are sold or handled on the premises. The soda, or rather carbonic-acid water, and the artificial mineral-waters, are drawn from the large glass fountains in which they are made, so that the liquid is absolutely free from metallic contamination. The sirups, too, are made and stored only in glass or earthenware vessels, and drawn from glass tanks in the counter-apparatus. These are minor items, but they indicate the firm's principles and ambition.

In its pharmaceutical preparations, no house in America stands higher. Any preparation bearing the name of J. Milhau or J. Milhau's Son is known to the trade to be wholly trustworthy, as equal to any of its kind. At the present day there are many preparations put up under the same name by many firms; and it is by this class that the public are most deceived; for example: "Beef, Wine, and Iron;" "Sirup of the Hypophosphites;" "Cod-Liver Oil and Hypophosphites;" "Cod-Liver Oil and Phosphate of Lime;" "Elixir of Calisaya Bark," a tonic which originated with this house, and which, although extensively imitated, is never equalled; "Elixir of Calisaya with Iron;" "Elixir of Cocoa-Leaf" (the sacred plant of the Incas of Peru), a valuable hair-dressing from a prescription of Dr. Dupuytren, oddly enough known as the "Elizabethtown hair-wash;" "Eau de Florence," a pleasant and excellent tooth-wash containing true Florentine orris-root; "Creosote Tooth-Wash," more strongly antiseptic than the foregoing, and already forty years in good repute. Nearly all these or similarly sounding titles are to be found in the lists of preparations of apothecaries throughout the country; but people ought to be thoroughly impressed with the fact, that such preparations without the brand of a house like this one, in unquestioned standing, should be very cautiously avoided. In "Beef, Wine, and Iron," for instance, many places offer the preparation for less money than the actual cost of the pure extract of beef and good wine which the proper preparation ought to contain; other concerns buy the cheapest extracts, and sell at the usual prices; while the goods that are put up by the best firms make the reputation upon which less scrupulous firms make the profits. The substitutes for "Elixir of Calisaya Bark," originally put up by this house, as a rule, are made with cinchonine; and some, though prepared from the bark, contain an excess of the cinchotannates, none of which in practice are found to be appetizing, and assimilable restoratives or anti-malarials. Thus it becomes necessary for people using popular preparations to ascertain the firms who are the most trustworthy pharmacists.

When the firm was in its earlier stage, its location was in the midst of the best residence district, and its prescription business was one of the largest in the city. The surroundings now are almost all business concerns; and yet the prescription department is very large, the old patrons gathered in the course of nearly three-quarters of a century being represented in second, third, and fourth generations.

In consequence of long continuous relations with prominent houses of Europe and America, this firm is enabled to increase and replenish, by fresh direct importations and advantageous purchases, their already unexcelled stock of goods; so that the establishment always exhibits an unrivalled variety of foreign and domestic drugs, medicines, choice pharmaceutical preparations, rare chemicals, and new remedies.

Moreover, the firm are the American agents for a number of pharmacists in Europe and America, among which may be cited that of the Déclat Manufacturing Company, which makes the antiseptic preparations formulated by Dr. Déclat, the Paris physician who has earned a world-wide reputation for his scientific application of "Phenic Acid," obtained chemically pure, to the uses of medicine; "Phenic Acid" being already recognized as one of the most powerful antiseptics, and the Déclat method, by which its use is made effectual and practicable, an important addition to medical science; while the Déclat preparations are regarded by eminent physicians as among the most valuable additions to the *materia medica* since the introduction of quinine.

The business started by John Milhau is now conducted under the name of John Milhau's Son; the son, Edward L. Milhau, having been connected with the firm as clerk, partner, and proprietor for about thirty-three years. It is a pleasure thus to place before the reader of "Science" a sketch of a house which has had such marked success, while sacrificing many enticing obtainable pecuniary rewards for the maintenance of true principles.

The Prang Educational Company,

PUBLISHERS, BOOKSELLERS,

AND

Manufacturers and Dealers in Educational Apparatus and Materials.

Microscopes and Microscopic Supplies.

Chemical Apparatus. Physical Apparatus.

CORRESPONDENCE SOLICITED.

The Prang Educational Company,

No. 7 PARK ST., BOSTON, MASS.

THE BLAIR TOUROGRAPH.

We manufacture not only the Tourograph, but all styles and sizes of light-weight cameras, suitable for every variety of work, both in and out of doors.

With one of our Outfits, and the Instruction-Book which accompanies it, the

AMATEUR PHOTOGRAPHER

is sure to succeed.

We furnish every thing that is necessary to make a complete outfit, if desired.

Send for catalogue, and be convinced that we have the best line of portable cameras made in this country.

THE BLAIR TOUROGRAPH AND DRY PLATE CO.,
471-475 TREMONT STREET, BOSTON, MASS.

FINE PRINTING OF MAGAZINES, BOOKS, Pamphlets, and Commercial Work, may be secured at the office of

ROCKWELL & CHURCHILL,

39 ARCH STREET, BOSTON

☞ Take a look at the "Wide-Awake" and "Wheelman" monthlies, and obtain an inkling of the unsurpassed illustrated work we are daily performing.

The Cross Pen Company,

79 FRANKLIN STREET, BOSTON.

Sample offer,—our perfect Stylographic Pen (A. T. Cross patents), with ink, for six months' use, to any address for TWO DOLLARS.

Liberal offer to clubs of three or more. Send for pen and circular.

CHEMICAL TEXT-BOOKS.

BY JOHN HOWARD APPLETON,

Professor of Chemistry in Brown University.

1. *The Young Chemist*	Price	.90
2. *Qualitative Analysis*	"	.90
3. *Quantitative Analysis*	"	$1.50
4. *Laboratory Handbook*	"	.12

These books are unsurpassed in the help they afford to teachers.

Copies sent by mail, postpaid, upon receipt of the advertised price, by
G. ROSCOE & COMPANY, Box 17, Providence, R.I.

ARTISTS' MATERIALS

OF EVERY DESCRIPTION.

NOVELTIES FOR DECORATING.

Manufacturers' Agents for Tucker & Greene's Oil Colors.

A. A. WALKER & CO.,

No. 538 WASHINGTON STREET, BOSTON.

Next door to R. H. White & Co.

THE

HELIOTYPE PRINTING COMPANY,

No. 211 TREMONT ST., BOSTON, MASS.,

ARE PRODUCERS OF ILLUSTRATIONS BY THE

MOST APPROVED

PHOTO-MECHANICAL, PHOTO-LITHOGRAPHIC, AND PHOTO-ENGRAVING PROCESSES.

Employed by the United States Government in illustrating *Scientific* and Medical Reports, by *Scientific*, Historical, and other learned societies; by the leading publishers; and for illustrating Town and Family Histories, Trade Catalogues, Show-Cards, etc.

Facsimiles of Medals and Coins, Ancient Manuscripts, Paintings, Drawings, Sketches, and Autograph Circulars, Views and Portraits from Nature, Medical and Scientific objects, Antiquities, etc.

Special attention paid to the Reproduction of Architects', Engineers', and Surveyors' Drawings.

ESTIMATES AND SPECIMENS FURNISHED ON APPLICATION.

BRADSTREET'S BINDERY.

THE BRADSTREET BINDERY

Is ably prepared to do every kind of binding in leather, from the ordinary periodical to the most precious set of volumes, in plain leather, or the costliest vellum, levant, morocco, calf, and Russia, with simple or elaborate hand tooling. The attention of private illustrators, and owners of valuable private libraries, is especially invited.

OWNED BY THE

BRADSTREET'S MERCANTILE AGENCY,

279 BROADWAY, NEW-YORK CITY.

NEW ENGLAND

MUTUAL

LIFE INSURANCE COMPANY

OF BOSTON, MASS.

CHARTERED 1835. ORGANIZED 1843.

THIRTY-NINTH ANNUAL STATEMENT.

FINANCIAL STATEMENT.

Assets		$16,128,265.94
RECEIPTS.		
For Premiums	$1,824,587.77	
For Interest and Rents, less Taxes	784,678.83	
Balance of Profit and Loss Account	20,487.56	2,629,754.16
Total		$18,758,020.10
DISBURSEMENTS.		
Death Claims	$1,004,869.00	
Matured and Discounted Endowments	333,914.00	
Cancelled and Surrendered Policies	134,500.67	
Distribution of Surplus,	516,903.99	
Total paid to Policy-holders	$1,990,187.66	
Commissions to Agents,	130,305.66	
Salaries, Medical Fees, and Advertising	103,162.67	
Printing, Stationery, and all other incidental expenses at Home Office and Agencies	99,782.41	
Interest paid for Premium on Investments, and accrued interest thereon	2,399.85	2,325,838.25
		$16,432,181.85
LIABILITIES.		
Reserve at 4 per cent, Mass. standard	$13,645,165.56	
Balance Distributions unpaid	78,765.06	
Death and Endowment Claims unpaid	140,959.00	13,864,889.62
Surplus, Mass. Standard, 4 per cent		$2,567,292.23

BUSINESS FOR 1882.

Number of Policies issued in 1882 2,066
Amount insured, $6,080,851
Number of Policies outstanding 19,854
Amount of same, $59,207,737
Number of Policies terminated by death upon 263 persons 298
Amount of same, $1,010,378
Number of Policies terminated by matured and discounted endowments upon 155 persons . 155
Amount of same, $316,139

MASSACHUSETTS LAWS.

The Laws of Massachusetts provide that,

1st, No Policy shall become forfeited or void for non-payment of premium, after the payment of Two Annual Premiums.

2d, In default of payment of subsequent Premiums, it is binding on the Company to issue a Paid-up Policy, as provided for according to the published Tables.

The above conditions are available to all Policy-holders who become such after Jan. 1, 1881, without further negotiation or stipulation or notification on their part.

DISTRIBUTIONS OF SURPLUS

are made Annually on the Contribution System, and are progressive.

LIBERALITY AND EQUITY

in its relations with Policy-holders have always been the governing principles of this Company; and the conditions of its Policies in regard to limits of

RESIDENCE AND TRAVEL

are of the most liberal description.

☞ Before insuring in any Company, carefully read the Application and form of Policy used by the NEW ENGLAND MUTUAL LIFE.

POLICIES OF ALL KINDS ISSUED UNDER THE NON-FORFEITURE LAWS OF MASSACHUSETTS.

(NO POLICIES ON THE TONTINE PLAN ARE ISSUED BY THIS COMPANY.)

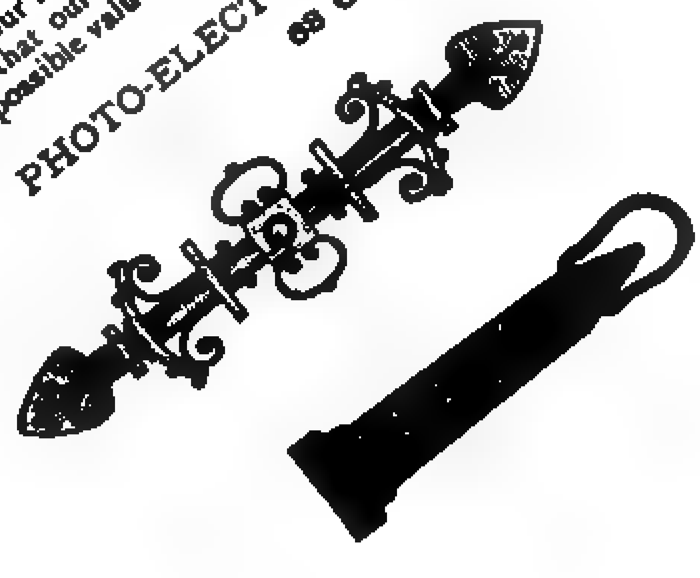
BENJAMIN F. STEVENS, President. JOSEPH M. GIBBENS, Secretary.

SCIENCE

appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.;*" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.



FRIDAY, MARCH 30, 1883.

SCIENCE AND THE NEWSPAPERS.

WE hear a great deal about the educating influence of the press, and it cannot be denied that this influence is very great. Every one reads the newspapers, and is more or less affected by them. To say that the press exerts a great educational influence is, however, not necessarily praise; for this influence may be bad, and in some respects it undoubtedly is bad. Leaving out of consideration the obvious illustrations of this truth, it seems to be desirable to call special attention to one direction in which the newspapers, as a rule, signally fail in their attempts to educate the public; and that is, in reporting the transactions of the meetings of scientific associations. Fortunately the attempts are not often made; but, when they are, the results are quite different from what the editors probably desire. The intention of the editors is, we take it, really to inform the public, in an honest, straightforward way, what the papers presented at the meetings are about. Perhaps the gentlemen think that this is actually accomplished: nothing can be farther from the truth. Usually, instead of a clear statement, a column or two of the veriest nonsense is strung together by a young reporter entirely ignorant of the first principles of the simplest science. The matter passes into the office, and is accepted by an editor as ignorant of science as the reporter; and the result is, that science is belittled, and the public deceived — certainly not educated. When ignorance alone is exhibited in these reports, they may be regarded with equanimity by those who are informed; for the ignorance of the writer appears on the surface, and no one can or does hold the author of the paper responsible. But when, added to the ignorance, there is a tendency to ridicule, to turn matters of grave importance into petty jokes, — in general, to betray a flippant spirit in the treatment of the subjects discussed, — then it is time for science to enter a protest, not in the interests of scientific men (for newspaper reports, no matter how bad, do them little harm), but in the interests of science itself.

When a newspaper in a semi-civilized region makes sport of death; when an execution is emphasized by mirth-provoking head-lines; when the most sacred things are ridiculed, — the refined members of the community are shocked. So, too, when the earnest efforts of investigators are used by strangely incompetent young men for the purpose of exhibiting their sophomoric humor, those whose senses in matters of science are in the least refined feel outraged. They feel that the newspapers which lend themselves to such abuses are guilty of a sacrilege for which they should be held responsible. The harm done is both positive and negative, — it is positive in so far as entirely false notions in regard to the work of scientific men are given currency, and ignorance is encouraged; it is negative in so far as the opportunity for really correctly informing the public is lost.

All who hold science in reverence; who believe, that, through scientific investigation in every direction open to us, the truth will at last be reached; who believe that the spread of correct ideas concerning natural phenomena will eventually dispel that superstition which is now the great enemy of progress, — all such cannot but deplore any thing which in a tangible way is opposed to the development of scientific culture. We call upon the editors of our great daily newspapers to carefully consider the subject, and to endeavor to remedy what must be regarded as a grave difficulty. Better no reports at all than such as are usually furnished; but the work of reporting might easily be well done, and, if well done, would be of value.

THE PRESENT STATE OF SCIENCE IN BRAZIL.

THE last ten or fifteen years have witnessed a marked awakening in Brazil to the importance of scientific research, and the inauguration of what may fairly be termed a new movement, of which, so far as the writer is aware, no account has yet been given to the outside world; while Brazilians themselves are

perhaps, for the most part, unaware of the importance and promise of the scientific activity developed in their midst by a small group of earnest workers. Although Brazil has, ever since the abandonment of the narrow, restrictive, colonial policy of Portugal which proscribed foreigners, been the chosen field of research of many eminent foreign naturalists, the Brazilians have, with a few honorable exceptions, been content to receive at second hand their knowledge of the natural history of their own country, and have seldom undertaken, on their own account, to supplement and correct the work of foreign naturalists, much of which is necessarily incomplete and erroneous. Nor has the government, until recently, granted well-directed and sustained aid in favor of scientific investigations; although it has for many years maintained, at considerable expense, scientific departments in all the higher institutions of learning, and in establishments like the national observatory and museum, and has, in a few instances, organized surveys and exploring expeditions. Through bad organization or insufficient support, the scientific results of all these efforts have, however, been of small value. While this unsatisfactory state of affairs, so natural in a new country, has been the rule, it should not be overlooked that the government has, for a number of years, given an annual subsidy of about five thousand dollars towards the completion and publication of von Martius' great Flora braziliensis; and several foreign naturalists have, like Agassiz, received important official and private encouragement and aid in the prosecution of their researches.

Towards the close of the colonial period a promising scientific movement was begun, which received a severe check from the political troubles attending and following the emancipation of the country from Portuguese rule, — a check from which science in the empire is only just beginning to recover. At that time the national museum was established, having as a nucleus the splendid mineralogical collection of Werner, that, after a strange succession of mishaps, came to a final resting-place in Rio de Janeiro. An able mineralogist and geologist, Baron von Eschwege, was made inspector of mines, and, for about a dozen years, investigated, with admirable proficiency, the geology and mineralogy of the gold and diamond regions; while Pohl and Sellew carried on investigations in other parts, in part at least under government auspices. Two Brazilian mineralogists, Andrada and Camara, were drawn into politics; and in the former an able scientific man was transformed into the patriarch of Brazilian independence. At or about the same time, Friar Velloso prepared an important work on Brazilian botany, of which, unfortunately, only the plates were, until recently, published. The later work of Freire Allemão in the same field, being produced at a time of almost complete indifference to science, have for the most part been lost, or remain unpublished, as has also happened to that of Alves Serrão, Burlemaqui, and Capanema, in geology and mineralogy, and of the poet Gonçalves Dias in ethnology.

For a long period what passed for science in Brazil was characterized by an almost complete absence of investigation; and although there are many names with a local, or even national, reputation as teachers or writers on scientific subjects, it is difficult to find any solid contributions in the field of either the natural or physical sciences. Even to-day there are many reputations that have no real basis in original work of merit. The appearance, therefore, of a group, however small, of real investigators, marks the beginning of a new era; and, although this beginning is as yet a very modest one, its effect is already being felt, and will increase from year to year. This awakening to a knowledge of what science really is, and of the true methods of pursuing it, may be ascribed to various causes. The increased facilities of communications, and the constantly widening relations with foreign countries, the new life and energy developed by a great struggle like the Paraguayan war, the visit of Professor Agassiz in 1864, and the visits of the emperor to Europe and the United States, — have probably been the most important determining causes. Of these, the last is by no means the least. With a strongly developed scientific taste, and with such knowledge as could be obtained with the means at his command and in the non-scientific environment in which he was placed, the emperor profited to the utmost, in his travels, to associate with scientific men, to visit museums and schools, and to acquaint himself thoroughly with the means and methods of research; so that he returned with clearer conceptions of what was best to encourage and promote in his own country. Within the last ten or fifteen years the higher schools and scientific establishments have been reformed and given a better organization, new departments, and increased appropriations, which, although still very small for their needs, are princely in comparison with what they formerly received; an efficient mining-school has been established;

professors and specialists have been imported from abroad, though not to the extent that would have been expedient for some of the new departments and for work new in the country; a geological survey was organized, though, being somewhat in advance of its time, it was, from a spirit of short-sighted economy, suspended after two years of efficient work; the practice of attaching naturalists to engineering explorations has been adopted; and in many other ways scientific research is being promoted.

At present the national museum and observatory in Rio, and the school of mines at Ouro Preto, are the principal centres of scientific activity. The latter, being a comparatively new establishment, remote from the centralizing tendencies of the capital, organized on European models, and controlled by an able corps of French specialists, has escaped many of the vices of organization of the older institutions. The two former, although badly handicapped by lack of means and defective organization, have outstripped the other institutions that ought naturally to be important scientific centres, because in them the reform was more radical and complete, and, the working-corps being small and for the most part new, the chances of filling the places with competent specialists have been far greater than in the medical schools of Rio and Bahia, the polytechnic school and the Dom Pedro Segundo college at Rio. In these a greater number of the defects of the old organization are still retained, and some of the new features are of doubtful utility, while the whole organization is still too cumbersome and centralized for efficient special work in any department. The system of filling the professorships by competitive examination, as it has been conducted, too often gives the showy qualities of rhetoric and smartness the preference over solid merit as proved by original research; and the most competent often refuse to enter, or, if they do enter, are beaten in a competition in which a majority of the examining board has only very superficial knowledge of the subject of the chair to be filled.

The national observatory, now under the direction of Dr. L. Cruls, has of late years been completing its equipment, and has recently commenced the publication in French of a series of annals. Aside from its regular work, it organized four parties for the observation of the passage of Venus, two of which were outside of the limits of the empire. Astronomical work is also being carried on in a small private observatory by Dr. Pereira Reis, the former vice-director of the national observatory, and by some of his colleagues of the polytechnic school. The organization and equipment of this observatory by private individuals, assisted by voluntary contributions, is one of the most hopeful signs of the new scientific movement.

The national museum commenced in 1876 the publication of its Archivos, of which six volumes have already appeared, containing papers prepared in connection with the museum or with the extinct geological commission, the material of which is now incorporated with the museum. Among these papers, those of the late Professor Hartt on the archeology and ethnology of the Amazonas, of Drs. Lacerda and Peixoto on Indian crania, of Dr. Ladislau Netto and Ferreira Penna on Brazilian archeology, of Professor Derby on geology, of Dr. Lacerda on the physiological action of snake-poisons, and of Fritz Müller on insects and crustaceans, are worthy of special mention. A splendid monograph on the cretaceous invertebrate fossils, numbering over two hundred species, mostly new, collected by the geological commission, is now being prepared for the Archivos by Dr. C. A. White of the National museum of Washington, and will probably be followed by monographs on the equally rich carboniferous and Devonian faunas by Messrs. Derby and Rathbun, former members of the geological commission. The museum is at present devoting special attention to anthropological researches; to which the director, Dr. Ladislau Netto, is giving a large portion of his time, and lately held a very creditable exposition in this branch, by means of which considerable public interest was aroused, and large additions to the collections secured. The botanical work of the museum is under the direction of Dr. Nicolau Moreira, assisted by Mr. Schwache, an able German botanist. In the geological department Messrs. Derby and Freitas are chiefly occupied in the study, and preparation for publication, of the rich material accumulated by the geological commission, and, as far as circumstances will permit, in the prosecution of the geological study of the empire. The geological reconnoissance of the great São Francisco valley, and of the auriferous and diamantiferous belt of central Minas Geraes, by Professor Derby, is the most important of recent work done in this department. Under the direction of Dr. Couty of the polytechnic school, and Dr. Lacerda of the museum, a laboratory of experimental physiology was established some three years ago, annexed to the museum. In this, carefully conducted in-

vestigations on various subjects have been carried on, the results of which have been in part published in the French scientific journals. Of the work published in Portuguese, that of Dr. Lacerda, on the nature and physiological effects of snake and other poisons, and the successful application of permanganate of potash as an antidote to snake-poisons, is the most striking and important. The laboratory being open to investigators outside of the establishment, several have availed themselves of the opportunities thus afforded; and Messrs. Guimerães and Raposo have investigated the physiological effects of coffee, Paraguayan tea, and other alimentary substances; and Dr. Araujo Goes is now engaged in studying the microscopic organisms of pulmonary diseases.

The school of mines also has its annals, of which one volume has been published, containing important papers from the pen of the director, Professor Gorceix, on the mode of occurrence of the topaz, diamond, and other precious stones, and on the geology of the regions where they occur, as well as papers from the students of the school, which prove that it is training an able corps of investigators, from which much may be expected in the future. The second volume, now in preparation, will contain translations of the little-known papers of Lund on the bone-caverns of Lagoa Santa.

The past year has witnessed an almost complete reorganization of the medical school of Rio de Janeiro, with the establishment, on a liberal scale, of many new laboratories for instruction and research, from which much good work is naturally to be expected. Up to the present time the studies of Dr. Domingos Freire in organic chemistry, and on the microscopic organisms of yellow-fever, and the nature, cause, and treatment of that disease, are the most important that have appeared from that institution.

In the polytechnic school the era of investigation has been too recently introduced, and on too small a scale, to have yet produced any material results. Dr. Saldanha da Gama, in the botanical department, is studying the flora of the vicinity of Rio, and training his students in the methods of research; and important geological and mineralogical investigations are being carried on by Dr. Ennes da Souza, who has had the advantage of a thorough scientific training at Freiberg. The chemical department has just received as guests Professor Michler of the university of Zurich, now on a scientific visit to Brazil, and Dr. Sampaõ, a Brazilian graduate of the same university, who are conducting elaborate investigations on the chemistry of Brazilian vegetable products.

Brazil not having as yet reached that stage of scientific and material development in which scientific men can hope to gain a livelihood, and find means and time for investigation outside of the government schools and other establishments, little can be expected among private workers. Notwithstanding this fact, the development of what may be called the official science has been too slight to place it in advance of the non-official. Fritz Müller, a farmer in a German colony of southern Brazil, finds time for the zoölogical investigations that have given him a world-wide reputation; Glaziou, director of the public gardens of Rio, has contributed largely to the Flora braziliensis, and is probably unsurpassed in his knowledge of Brazilian botany; Rodrigues Peixoto, a practising physician, has been associated with Lacerda in important studies on Brazilian craniology; and Barbosa Rodrigues has worked extensively on the palms and orchids in botany, and in the fertile field of Amazonian ethnology.

Though the showing for Brazilian science is so small, and some of the work above mentioned may, on close scrutiny, prove to be somewhat crude and non-scientific in its methods and deductions, enough has been done to mark the dawning of a new era full of promise for the future, and characterized by the study of nature rather than the study of books. The small nucleus of investigators cannot fail to train disciples, to draw others around them, and to educate the government and people to the point of distinguishing true research from mere empty show and glitter. When once truly scientific methods come to be fairly naturalized in the country, the Brazilians will not be found lacking in the mental qualities that make able and original investigators. If scientific progress be slow, it will not be, as hitherto, from indifference, or ignorance of the true nature of science, but because the material development of the empire does not permit the facilities of research enjoyed in older and richer countries.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

IV.

In the English lighthouses, for which the de Meritens machine has also been adopted, another style of commutator is used, as shown

[1] Continued from No. 7.

in Fig. 13. In this arrangement, the terminals to which the conductors from the lamp and those from the two machines are connected have

FIG. 13.

practically the same relative positions as in the previous case. From these terminals pass stout copper strips, which can be clamped by binding-screws bearing the same numbers as the terminals. The locking-pieces in connection with the terminals of the machine can be connected by thick copper strips by the binding-screws corresponding to the lamp-cables; and to facilitate this coupling, the locking-pieces are more or less raised, so that the strips may cross each other without touching. In this way perfect contacts are obtained; but a longer time is required to change the combinations. Fig. 13 shows the connections when machine No. 2 is coupled for quantity. Fig. 14 allows the difference in height of the locking-pieces to be seen, and shows how machine No. 1 is coupled for quantity.

The metallic rails upon which the regulator rests have already been described. These rails are in direct communication with the large cable; and it is by them that the current arrives at the frame of the regulator, and thence to the carbons. The cable of the electro-magnet and the small cable are attached to two terminals (H and H′, Fig. 15) with insulated springs. These springs, pressing on two contacts under the lamp, make the appropriate connections.

The regulator itself is a combination of the Serrin and Berjot lamps. It comprises the two electro-magnets of the latter lamp, the armatures of which form an internal core, — one magnet having coarse wire, and placed direct in the circuit; the other having fine wire, and mounted in a derived current. The former acts on the articulated frame carrying the lower carbon; the latter acts on the disk brake controlling the clock-work.

Fig. 15 shows at S the electro-magnet with coarse wire acting by the arm Q on the frame. R and R′ are the springs which tend to raise this frame. L is the lever which serves to regulate the tension of the spring R: it is controlled by a screw, V, which can be turned by inserting a key at the hole O. The magnet with fine wire is placed symmetrically with the other on the opposite side of the clock-work.

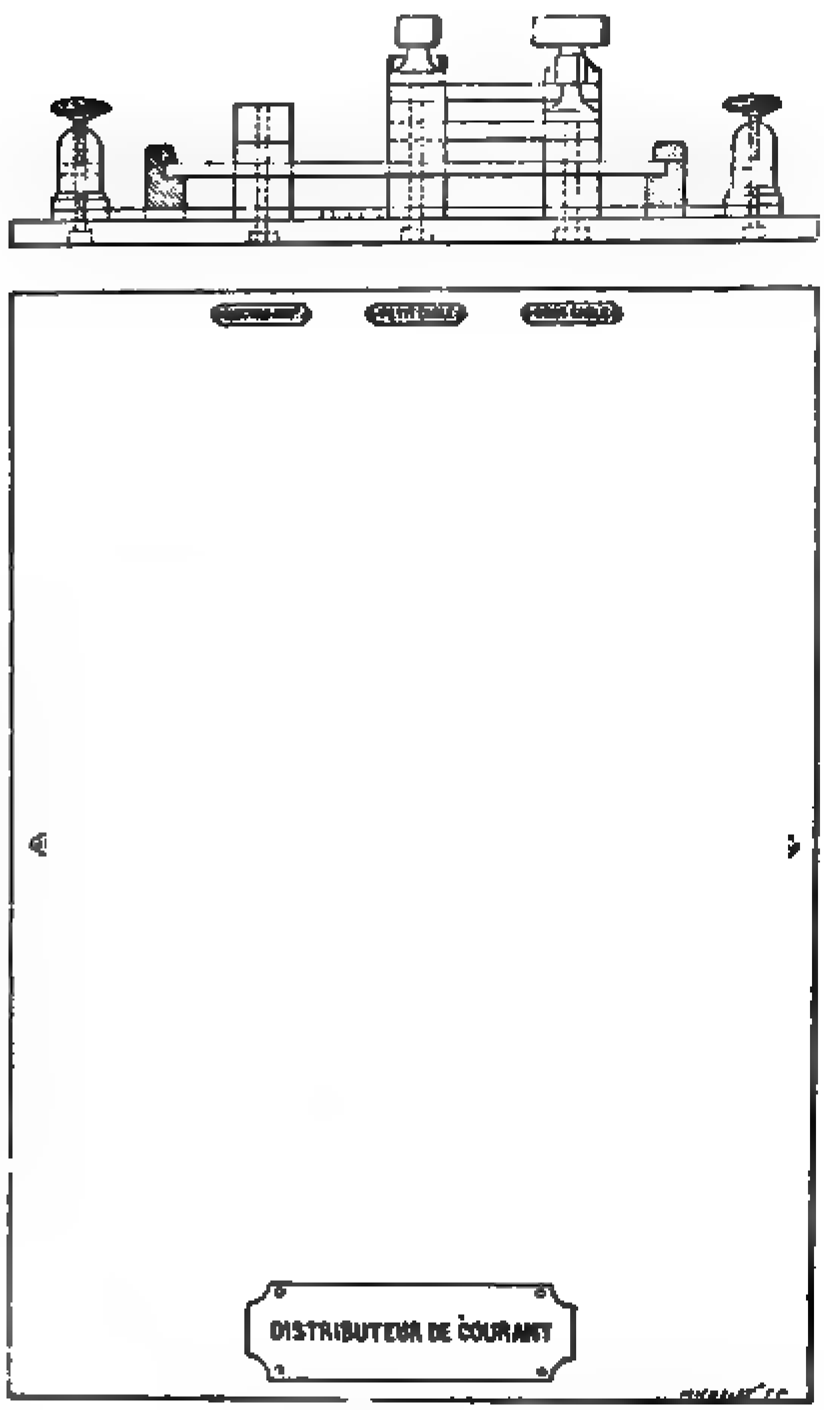


FIG. 14.

The connection of the two carbons to the prime mover of the clock is made by means of a steel ribbon, F, attached to the lower ends of the two rods *g* and *l*. This ribbon is led over several pulleys, and is wound on a wheel on the axis of the prime mover for a great part of its circumference. The turning of this

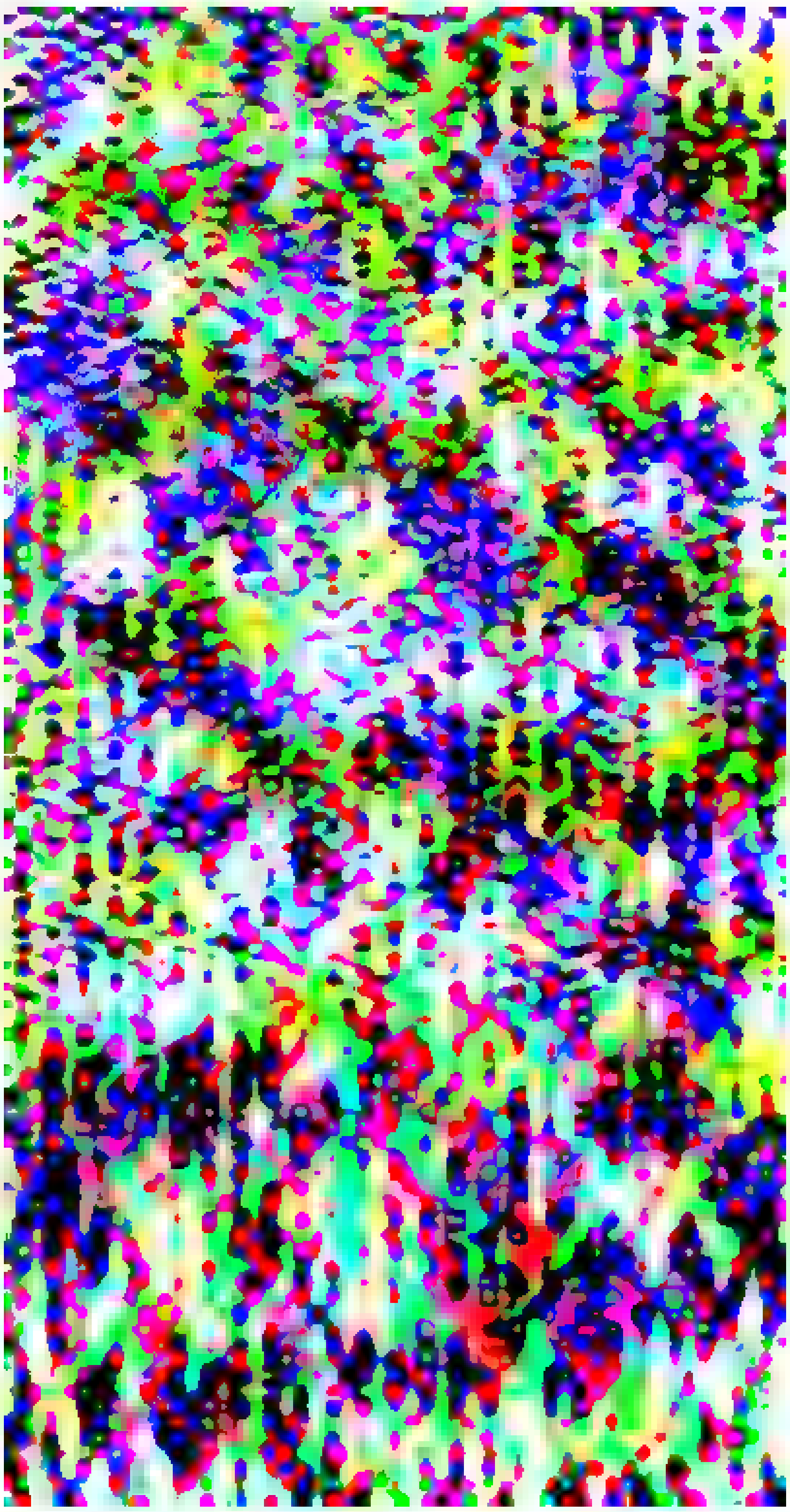


Fig. 15.

wheel is thus produced in a very certain manner. The rod *g* slides in the tube D fastened to the movable frame, and this tube is slit vertically to allow the attachment of the ribbon to pass. This manner of connecting the two carbons, which replaces the chain used by Serrin, and does away with the use of ratchet-wheels, allows the carbons to be placed at any desired height by a slight sliding of the ribbon.

Another peculiarity of this lamp is the mode of connecting the different interior parts of the apparatus. The current of the large cable arrives at the upper carbons by the rails and uninsulated portions of the regulator. From the lower carbon, it returns to the two insulated terminals H and H′, passing to one by the movable frame, and to the other through the electro-magnet S. The connections between the contacts are made with four thick spirals of nickel-plated copper. Two are shown at M and N.

The tube D, which carries the rod *g*, is not insulated from the frame; but the latter is insulated from the upright which supports it. This is on account of ease of construction, it being less difficult to insulate a straight piece than a round tube like D. An air-pump, T, serves to check the motions of the frame, and to prevent too rapid oscillations. The porous plate V is placed opposite the ends of the carbons, to protect the rods *t* and *l* from the excessive heat of the *foyer*. It is composed of the same material as the porous vases used in batteries. When the upper carbon rod arrives at the end of its course, it acts on a bevelled piece, which frees a contact spring, and suppresses the communication with the fine wire magnet, so that it may not be injured by the passage of too strong a current.

THE WEATHER IN JANUARY, 1883.

The monthly weather-review of the U.S. signal service contains copious statistics of the meteorological conditions, as observed at 171 regular stations in the United States and Canada, 224 stations occupied by voluntary observers, and 56 army-posts, besides various other sources of information. The following are given as the special features for the month:—

The very low mean temperatures. The departures from the normal are most marked for the upper lake-region, the upper Mississippi and Missouri valleys. The average temperature for all the districts east of the Rocky Mountain range was 3.3° below the normal.

The excessive rainfall over the south Atlantic and east Gulf states, with a marked deficiency in California.

The heavy snow-storms in the west, blockading or impeding all railroad traffic.

The chart on the opposite page has been reproduced by permission of the chief signal-officer from the regular chart No. III. of the signal-service series. It contains lines of equal air-pressure reduced to sea-level, lines of equal temperature unreduced, and mean

MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, JANUARY, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF THE CHIEF SIGNAL OFFICER.

monthly wind-directions as estimated from the observations of the month. This chart shows high pressures over the whole country, with northerly and north-westerly winds, the two combined producing the generally cold weather of the month. The extremes of cold, however, were not so great as is usual in January. The mean lowest minimum temperatures, from 47 stations of the signal-service in the different states, is $-6.8°$, while the same places indicate a mean greatest cold for all the years of observation of $-13.3°$. The following are exceptions: Pike's Peak, $-37°$, 4° lower than in the same month for the last eight years; Dubuque, Io., $-26°$, 2° lower; Pioche, Nev., $-17°$, 3° lower than before observed in Nevada; Santa Fé, N. Mex., $-13°$, 4° lower; and Spokane Falls, Washington Territory, $-28°$, 20° lower than before noted in the territory. The lowest temperature reported from any station was $-54°$, at Elko, Nev., on the morning of the 19th. The range of air-pressure was much less than during any January for five years.

There were sixteen storms traced within the United States and Canada. The following table gives the number of storms within the United States in each January since 1877. For the purpose of comparison, there are added the mean velocity, in miles per hour, of the storms in each month, as taken from the annual reports of the chief signal-officer.

TABLE OF JANUARY STORMS AND THEIR MEAN VELOCITY.

Year.	Number.	Velocity.	Year.	Number.	Velocity.
1877	14	37.7	1881	9	32.3
1878	12	26.3	1882	13	42.8
1879	8	35.5	1883	16	39.8
1880	14	37.6			

The heaviest snowfall was 52 inches, at Fort McDermitt, Nev.

The total movement of the wind ranged from 27,561 miles, on Mount Washington, to 1,853 miles, at Jacksonville. 100 miles per hour, and over, were reported from Mount Washington on the 3d (152, maximum for month), 4th, 12th, 18th, 20th, 21st, 24th, and 31st.

There were ordered up 149 cautionary signals, of which 79.9 per cent were fully justified.

No marked displays of the aurora were noted. Sun-spots were reported by Mr. D. P. Todd of Amherst, Mass., as seen on 11 days. They were least numerous at the first and last of the month, with a maximum frequency about the 16th.

An earthquake-shock was felt early on the morning of the 11th in Nashville, Jackson, Clarksville, and Memphis, Tenn.; Paducah, Ky.; Cairo, Anna, and Collinsville, Ill.; and at St. Louis and Protem, Mo.

A drought of great severity was reported from parts of Maine and Vermont.

Among numerous other statistics, are tables of monthly rainfall and mean temperature at Sacramento, Cal., for thirty years,—from 1853 to 1882 inclusive.

THE GEOLOGY OF LAKE SUPERIOR.

MR. SELWYN, the director of the Geological survey of Canada, has given in SCIENCE for Feb. 9 (p. 11) a note on the age of the rocks on the north shore of Lake Superior. The uncrystalline strata of the region, more or less associated with igneous rocks, are, as is well known, unconformable to and distinct from the Huronian. Mr. Selwyn includes them in ascending order in three groups, which will be found described in detail in the Geology of Canada in 1863.

1. Blackish and bluish argillites, with chert, and black or dark-gray magnesian limestones and sandstones, often with magnetite, the series being generally colored by carbonaceous matter.

2. Red and white sandstones and conglomerates, with red, white, and mottled shales, dolomites, and dolomitic marls, constituting the Nipigon group of Black bay and Nipigon bay. With these he classes, following Logan, the great mass of strata, including melaphyres, amygdaloids, and tufas, with native copper,—the Keweenian or cupriferous series of Michipicoton, Mamainse, and Pointe Aux Mines.

3. The sandstones of Sault St. Mary.

Between these three groups, according to Selwyn, 'there may be slight unconformities;' but he would include the whole of them in "those divisions of the great lower paleozoic system which underlie the Trenton group," and would call them lower Cambrian; asserting that there "is at present no evidence whatever of their holding any other place in the geological series," and "no sufficient reason for inventing or adopting new and unknown names for them."

These conclusions, it should be noticed, are arrived at after a first visit of a few weeks to certain parts of a vast, new, and peculiar region, which has engaged the attention, during the past forty years, of many skilled observers, who have collected, with regard to the whole of the Lake Superior basin, a great body of facts, and have reached conclusions with which Mr. Selwyn would seem to be wholly unacquainted. The problems presented by the rocks in question are far from being as simple as he supposes.

Mr. Selwyn includes in his second division both the Nipigon group of Bell and Hunt, and the Keweenian or cupriferous series, of which he conceives the third division, or St. Mary sandstone, "may be only the upper part, without any intermingling of volcanic material." This view of the continuity of the cupriferous series with the Potsdam (St. Mary) sandstone was maintained by Whitney; but Logan, in 1863, put forth strong, and to most minds conclusive, reasons for believing that the highly inclined cupriferous rocks at the east end of the lake pass unconformably below this sandstone (*Geol. Canada*, p. 85; also *Geol. report Canada for 1866–69*, p. 474). His conclusions have since been confirmed by other observers, notably by Strong and Irving in Wisconsin,

where the fossiliferous beds of the Potsdam rest horizontally on the upturned edges of the Keweenian, and are made up, in part, of its ruins. Parts 1 and 6 of the third volume of the Geology of Wisconsin (1880) will show the accumulation of evidence with regard to the stratigraphical relations of the Keweenian; and few will be found to-day to question the propriety of the conclusion announced by me in 1873, and subsequently by Major Brooks in 1875, that the copper-bearing rocks of northern Michigan constitute, in his words, "a distinct and independent series, marking a definite geological horizon," which has been designated the Keweenan series, Keweenawan, or, more euphoniously, Keweenian.

These rocks, so carefully studied by Brooks and Pumpelly on the south shore of Lake Superior, and largely displayed on Isle Royale, Michipicoton Island, Mamainse, and Pointe Aux Mines, on the north shore, were by Logan supposed to be the same with the red and white sandstone and marls, with dolomites and brine-springs, found along Nipigon Bay, Black Bay, and Thunder Cape. He recognized beneath these, in this region, the black slates, etc. (1 of Selwyn), which Logan supposed to form a lower subdivision of what he called the upper copper-bearing series, to distinguish it from the lower copper-bearing or Huronian series, which is overlaid unconformably by these black slates.

This lower subdivision, which I have called the Animikie group, though seen at Thunder Cape between the Huronian and the Nipigon series, is wanting in Black Bay, where Logan found the latter to rest directly upon the Laurentian; and also, according to Bell, on Lake Nipigon, where the Nipigon series reposes on Laurentian and Huronian. Apart from the evidence of its distinctness deducible from the absence of the Animikie in this area at the base of the Nipigon series, I have described a locality near Silver islet, where the basal beds of the Nipigon, resting upon the Animikie, hold pebbles of the characteristic rocks of the latter.

The mineralogical and lithological characteristics of the Nipigon rocks differ so much from the Keweenian as to create a suspicion that they may belong to two distinct series. In this connection an observation of Macfarlane is important. He found the true Keweenian at Mamainse to be uncomformably overlaid by a series of bluish sandstones and shales unlike those of the St. Mary series, and, on the contrary, closely resembling those of the Animikie group, to which he compares them. A summary of the evidence regarding these rocks will be found in my Azoic rocks (*2d geol. survey of Penn*, report E, pp. 230–241).

Meanwhile, it may be regarded as established that we have, in the Lake Superior basin, (1) the Keweenian or cupriferous series, resting unconformably upon the Huronian and other crystalline rocks, and (2) lower Cambrian (Potsdam) strata lying unconformably upon the Keweenian. We have, moreover, (3) the Animikie and (4) the Nipigon group,—two series of strata distinct from each other, and apparently from both of the preceding divisions. The observation of Macfarlane makes it probable that the Animikie belongs to a series newer than the Keweenian; in which case the lithological unlikeness of the still younger Nipigon group both to the Cambrian and the Ordovian (Siluro-Cambrian) rocks of the Lake Superior basin, would, as I have remarked in the report just cited, raise a suspicion that these red and variegated sandstones and marls, with dolomites and brine-springs, which we have called the Nipigon group, may belong to a higher geological horizon.

The name of the Quebec group was, as is well known, given by Logan to what, under the name of upper Taconic, had been long before described by Emmons as a great development of strata of the age of the calciferous and Potsdam divisions of New York. In the disturbed belt where this series is displayed, from the lower St. Lawrence to the Hudson-river valley, and beyond, it is now well known that there are included, besides rocks of this horizon, others of Trenton-Loraine (Ordovian) and of lower Helderberg age, together with older rocks, embracing the lower Taconic of Emmons and the still more ancient crystalline (Huronian) schists called by Logan 'altered Quebec group.' So far as known, there is nothing in this belt of disturbed, faulted, and often inverted strata which can be taken to represent the great Keweenian series. Logan, however, assumed the St. Mary sandstone to be of the age of the Chazy division of the New-York series, and then proceeded to call the underlying Keweenian calciferous or Quebec group, suggesting that the Kamanistiquia slates (Animikie series) might represent the Potsdam. These references, so far as regards the Chazy and calciferous, are embodied in Logan's maps of 1864 and 1866.

This view, which was never any thing more than a crude speculation, was soon shown to be untenable by the establishment of the Potsdam age of the sandstones overlying the Keweenian, both in Wisconsin, as we have already seen, and in northern Michigan, where Rominger finds these upper sandstones to be overlaid by calciferous and Chazy beds.

Unless we assume that every thing uncrystalline below the Trenton group is to be relegated to the Cambrian, there is no ground as yet for extending this name to the Keweenian; while the convenience of having a distinctive appellation for this vast metalliferous series will assure the name Keweenian a distinct and permanent place in geological nomenclature. T. STERRY HUNT.

Montreal, March 3, 1883.

THE AINOS OF JAPAN.

THE following is an extract from an article on Yezo, in the transactions of the Berlin *Gesellschaft für erdkunde*, 1883, No. 1. The article was written by Professor Dr. Brauns of Halle, who, during his recent geological excursion to Yezo, visited the large settlement of Saghalin Ainos, in the neighborhood of Sapporo.

The Aino race belongs to a type entirely different from that of the Japanese, to whom they are now subject. The fear that the number of the Ainos is diminishing, in consequence of the immigration of the Japanese into Yezo, to an extent that would soon lead to their extinction, is not well founded. According to the estimate of the Japanese government, the total number of Ainos in Yezo, Saghalin, and the Kurile islands, is less than 18,000. While some authors have accepted this estimate, others have set the number of Ainos in Yezo alone as high as 50,000, which, with the addition of those now living under Russian control in Saghalin (from 10,000 to 12,000), and in the southern part of Kamtschatka, would give a total of from 60,000 to 70,000. Although the latter estimate, which is based on a number of reports from different sources (e.g., the missionaries of Hakodate), comes nearer the mark, still the number of Japanese who have settled in Yezo is already greater than that of the Ainos. The Japanese government reports 100,000

Japanese in Yezo, which, making the usual allowance for official exaggeration in matters of this kind, must probably be reduced to about 80,000. Be this as it may, it is certain that the fertile island of Yezo, which is appreciated in a certain way by the Japanese, but which is very irrationally and imperfectly utilized, is very thinly populated. The island has an area of nearly 80,000 □ kilometres, and a population of only about two to the square kilometre.

The Ainos — whose unsophisticated artlessness, love of truth, peaceful disposition, hospitality, and discreet, modest, and sober deportment, by contrast with other orientals, strike one all the more agreeably — show, in their short but well-proportioned body, thick and beautiful hair, and physiognomy, particularly in the deep-set eyes, unmistakable agreements with people of more western countries, say, central Asia. In language, as well as customs and traditions, they are decidedly strangers to the Japanese; but, so peaceful are they, they submit freely to the yoke that has been placed upon them, without ever plotting mischief. Whether for them, as well as for the rich natural advantages of the island of Yezo, a colonization in European fashion would be a great benefit in comparison with that of the Japanese, who have much to learn and much to do for a long time to come in their own country, may here be left undecided. However, such a wish will certainly appear natural to all those who have gained a more intimate acquaintance with the island of Yezo and its inhabitants.

INFLUENCE OF THE VAGUS NERVE UPON THE HEART.

In continuation of his studies upon the physiology of the frog's heart, Löwit confirms[1] Gaskell's discovery, that in normal diastole the cardiac muscle is not completely relaxed, but in a state of slight tonic contraction: this, Löwit finds, is abolished during vagus inhibition. The powerful beats which usually follow a period of inhibition must be due to some change in the heart-muscle, and not in its motor-nerve centres; for Kronecker has proved that every cardiac contraction is maximal. Their cause Löwit finds in the more complete diastolic expansion; and he also explains similarly the more vigorous pulsations sometimes seen during a vagus stimulation not powerful enough to alter the heart's rate of beat. He confirms Schiff's usually ignored discovery, that stimulating the pneumogastric sometimes quickens the pulse; but, after a careful study of the circumstances under which this phenomenon occurs, he rejects Schiff's hypothesis, that the vagus contains only one set of heart nerve-fibres, whose action varies with degree of stimulation, etc. We must assume two distinct sets of fibres, — a cardio-accelerator and a cardio-inhibitory: the latter are more irritable, but more easily injured, bearing thus the same relationship to the accelerator fibres as do the vaso-constrictory nerves to the vaso-dilator, according to Goltz. By exposing the frog's vagus to the action of substances, as nitre, which are known to diminish nerve irritability, one can turn the vagus into a pulse-quickening nerve: on washing out the nitre, it again becomes pulse-slowing; and so, back and forth, several times, until death-changes commence. In mammalia the phenomenon cannot be reproduced with the same certainty; but occasionally one can succeed in getting the vagus into a condition in which its inhibitory fibres are not irritable, while the accelerator are. During vagus acceleration the frog's ventricle becomes paler, indicating a contracted condition of its musculature even in diastole. This abnormal state of tonic contraction is not the cause of the acceleration, for the pallor may precede the pulse-quickening, or last after it; and weak stimuli sometimes cause acceleration with no pallor. The small pulsations usually seen during the acceleration are due to the increased tonicity of the heart-muscle usually present at the same time, and preventing diastolic relaxation of normal extent. The accelerator fibres probably act on motor-nerve centres in the heart, arousing processes, which, when feeble, merely alter the rate of beat; when more powerful, also increase the tonus of the heart-muscle.

H. Newell Martin.

[1] Pflüger's archiv, xxix. 469.

THE EXTINCT LAKE AGASSIZ.

In the recently published Tenth annual report of the geological and natural-history survey of Minnesota, for 1881, Prof. N. H. Winchell gives an abstract (p. 5) of Mr. Warren Upham's observations on the shore-lines of the great sheet of water that once flooded the valley of the Red River of the North, and overflowed southward into the Minnesota. "The lake had three stationary periods, forming three beaches. They all ascend above a given datum level toward the north, the rate increasing in going toward the north. The highest beach-line ascends 125 feet in about 150 miles, the beach being one continuous shore-line. The northern portion of the lake fell at intervals from this high beach-line, . . . while the water-level in the extreme southern part stood nearly stationary, the northern fractional beaches converging into one toward the southern extremity of the lake. The next distinct beach, found in the southern part of the region, ascends toward the north 70 feet in 150 miles. . . . The fall of the lake had therefore been sixty feet more at the northern than at the southern end. . . . The third beach-line, formed when the outlet had been excavated to the level of Lake Traverse, is known along a distance of 135 miles; and its northward ascent was at first 50 feet, and afterwards only about 25 feet. . . . The fall of Lake Agassiz from the highest beach level to the third at Lake Traverse was about 80 feet, and, in the vicinity of Maple Lake, 165 feet. . . . These phenomena seem inconsistent with that hypothesis which supposes an elevation of northern land as a barrier to contain this vast inland lake, inasmuch as these beaches would have to present a slope in the opposite direction, in order to change the outlet from Lake Traverse to Hudson's Bay. . . . They have been ascribed to the operation of the glacial period in the epoch of its decline, when the ice still existed toward the north as a barrier to prevent northern drainage; . . . and in the opinion of Mr. Upham, its attraction was sufficient to move the mass of water toward itself, and to cause an ascending shore-line in that direction. . . . Lake Agassiz probably covered Red Lake under 50 or 100 feet of water above its present level, Lake of the Woods under about 200 feet, the Red River Valley at St. Vincent 450 feet, and Lake Winnipeg about 600 feet." The area thus flooded is much larger than heretofore supposed.

LETTERS TO THE EDITOR.

Movement of the arms in walking.

It seems to me I can best lay this ghost of our animal origin by drawing attention to the fact that the swinging of any part that is sufficiently free may be

used for steadying the body in walking. In man the arms are used, because most movable; but in lower animals the head is most often used. The domestic fowl moves the head back and forth alternately with the movement of the legs; the horse moves the head up and down; the cow moves the nose back and forth.

Are these movements ghosts of a former real walking with the head? JOSEPH LECONTE.

Berkeley, Cal., March 7, 1883.

Suggested improvement in lighthouses.

The articles in SCIENCE during March, on the use of the electric light in lighthouses, recalls what I think is a most useful improvement suggested, or at least advocated, by an English yachtsman, — Mr. R. F. McMullen, — in a little book called the 'Voyage of the Orion.' In the vicinity of a powerful lighthouse, whether lighted by electricity or otherwise, the great glare of the light completely blinds the eye of the navigator. To remedy this, Mr. McMullen proposes that a colored shade should be fixed so as to change the color of, and diminish, the light within a fixed radius of from one to three miles, according to circumstances. Thus, besides the protection given the eye from too much glare within the radius of the shade, the navigator would also be warned that he was within a known distance of the light, — a consideration which would often be of much value.

I sincerely hope that our Lighthouse board may make some experimental trials of this plan, as well as turn its attention to the adoption of flashing lights, instead of revolving lights with long periods of darkness. Indeed, in our whole system of lights, and also of buoys and other 'day-marks,' we are behind the times. EDWARD BURGESS,

Boston society of natural history,
March 12, 1883.

Fluidal cavities in quartz-grains of sandstones.

It is interesting to note that the minute cavities containing a liquid and moving bubble, so common in the quartz of granite rocks, are also to be found in sandstones. This is especially the case with a hard, compact Potsdam sandstone quarried at Fort Ann, Washington county, N.Y. The cavities, though very minute, are abundant, and the included bubble very sensitive, being in a constant state of rapid movement. G. P. MERRILL.

U. S. national museum.

The copper-bearing rocks of Lake Superior.

In SCIENCE, No. 5, Professor Irving takes issue with my statement that there is no evidence whatever of the Lake Superior copper rocks holding any other place in the geological series than that which includes Potsdam and primordial Silurian or lower Cambrian.

In making the statement, I referred only to those parts of the north shore, extending from Sault St. Mary to Thunder Bay, which I have myself examined.

I could not presume to discuss, much less to dispute, the evidence which Professor Irving adduces, in disproof of my statement, from the St. Croix region and the south shore, neither of which I have ever seen; but I may be permitted to say, that the unconformities mentioned by Professor Irving, and which I have no doubt are real, do not, in my opinion, in the least invalidate my statement. Unconformities, even if locally very great, are not necessarily any indication of a great time-gap. And it seems to me that too much importance has been attached to these by Professor Irving, and far too little to the immense difference in the physical condition of the groups he now correlates; viz., the original Huronian of the north shore of Lake Huron, and Hunt's Animikie group, lower Cambrian of Thunder Bay, or, to come closer, the cleaved roofing-slates of Thompson in Minnesota, and the horizontal micaceous argillites, black dolomites, and cherty rocks, of Pie Island, McKay's Mountain, Thunder Cape, etc.

In Canada, at least, these two formations are absolutely and undoubtedly distinct, physically, mineralogically, and geologically; while the latter, as seen around Thunder Bay, is followed in almost conformable sequence by the red and white quartzose sandstones, conglomerates, amygdaloids, etc., of the so-called upper copper-bearing or Keweenian series of Hunt. These I have examined from Thunder Bay, around the north shore to Gros Cap, where they rest directly on the Laurentian gneiss, the Animikie group and the underlying Huronian being wanting. A short distance to the east, however, the latter appears in full force, but overlaid neither by Animikie nor by Keweenian (i.e., lower Cambrian), but by the Sault St. Mary sandstones, which, in view of their relation to the Black River limestone above them, and to the Keweenian in Gonlais and Bachewarmg Bays, are much more probably representative of the horizon of the St. Peters sandstone, or Chazy and calciferous, than of the St. Croix Potsdam. The respective limits of the two sandstones on the south shore seem uncertain.

The arrangement above indicated brings the whole succession of the Lake Superior, Cambrian, and Cambro-Silurian formations into perfect accord with that of the same formations in the Appalachian region, where, as I have elsewhere stated, indications of local contemporaneous volcanic action are not wanting at about the same horizon — lower Cambrian and upper Huronian — as that at which they occur in the Lake Superior region; the chief difference being, that the formations in the former region are folded and metamorphosed almost past recognition, and in the latter not more so than are many similar rocks of cretaceous and tertiary age.

I think, if Professor Irving could visit Michipicoton Island, he would be able to recognize plenty of volcanic detrital matter or tuffs among the copper-bearing rocks. The vast areas over which I have examined the ejectamenta of the extinct tertiary volcanoes of Australia enables me very readily to recognize such rocks when seen; but their occurrence at Michipicoton, and elsewhere on the north shore, is no proof that they also occur to the south, and therefore I fail to see why Professor Irving should dissent from my statement on this point.

ALFRED R. C. SELWYN,
Director Geol. and nat. hist. surv. of Canada.

Ottawa, March 14, 1883.

Snow-drifts.

Having often noticed the drifting of snow in parallel lines over the ice on our lakes, this explanation has suggested itself. Very often, when the wind drives the snow against any object, as a tree or fence-post, the snow will be hollowed out on the side toward the wind, and heaped up on the other side. This is explained by the fact that the tree acts as a reflecting surface, creating a counter-current of air, and preventing the accumulation of snow on the side toward the wind.

Might not the parallel ridges of snow on ice be explained in the same way? The first deposit of snow is caused by the flakes catching on some inequality or damp spot on the ice. This deposit acts as a re-

flector, and, by forming a counter-current, prevents another ridge forming near it, but favors the formation of a *parallel* ridge at a little distance. The second ridge thus formed acts in the same way as the first, and so on. After the first ridge is once formed, snow would accumulate on the side of it away from the wind, just as in the case of the tree.

JACOB REIGHARD.

La Porte, Ind., Feb. 27.

PREHISTORIC MAN.

Le Préhistorique: Antiquité de l'homme. Par GABRIEL DE MORTILLET, professeur d'anthropologie préhistorique à l'École d'anthropologie de Paris. (Bibliothèque des sciences contemp.) Paris, *C. Reinwald*, 1883. 642 p. 8°.

IN this latest and most important work of the distinguished *conservateur* in the prehistoric department of the *Musée des antiquités nationales de Saint-Germain*, we find exemplified in the highest degree both the merits and the faults of his previous writings. His merits consist in simplicity and elegance of style, and a marvellous capacity for the classification and arrangement of the innumerable details of an infant science, with whose minutiae he displays the most intimate acquaintance. This profound knowledge is combined with a very cautious and conservative spirit in accepting assumed facts, and is accompanied by an inexhaustible patience in their investigation. But as a counterweight to these high qualifications in a teacher of science, he displays a hastiness in his generalizations which will not wait for the slow and steady growth of knowledge, and a dogmatism which insists on forcing upon the world his crude speculations as the accepted truths of science. But what is even more unfortunate (although we can readily account for the existence of such a feeling in a man of science in France at the present time), his resistance to the reactionary spirit of clericalism seems to have resulted in a state of active and bitter hostility to all religion whatsoever. His attitude towards the bigoted and ignorant opposition of religious men to the overwhelming evidence of the antiquity of man can hardly be considered as '*dowered with the hate of hate, the scorn of scorn.*' He more than repays them in their own coin; as when he tells us that "the quaternary man *lived in peace*, entirely unprovided with religious ideas," or speaks of Cuvier as "the illustrious professor of the museum, creator of a new science, but doubled with a mediocre counsellor of state, posing as the defender of what then, as now, was called *the moral order.*" So we cannot help feeling that there must be a little personal pique to account for his sneer at 'certain great academies' which have not yet granted their letters of naturalization to 'palethnological studies;' and we can scarcely believe him to be serious in his complaint that these new doctrines have not yet found their way into the elementary text-books.

Upon the disputed points in prehistoric archeology he utters no uncertain sound. The first part of the work, embracing fifteen entire chapters, is devoted to 'The tertiary man,' although such a title seems to be somewhat inconsistent with his conclusion, that, "during the tertiary times, there existed a being intelligent enough to produce fire, and to fabricate instruments of stone; but this being was not yet a man." He was '*the precursor of man*,' — an ancestral form intermediate between him and the anthropoid apes of the present day. For this remote ancestor of ours, whose organic remains, he admits, have not as yet been met with, he has provided the long and learned appellation of the Anthropopithecus; and this achievement he modestly compares to Leverrier's discovery of a planet, or to the recovery by the philologists of the Aryans from the *débris* of their language. He even goes so far as to assure us that there were at least three species of this long-named creature, the first of which he calls A. Bourgeoisii, named from the late Abbé Bourgeois of Thenay, near Tours in central France, who has been most indefatigable in his search for traces of man in tertiary times. Then comes A. Ramesii, so called from M. Rames, who made a similar discovery near Aurillac in Auvergne. Finally there is A. Ribeiroii, whose appellative is derived from Col. Ribeiro, director of the geological bureau of Portugal, who believes that he has found traces of the existence of man, at that remote epoch, in the valley of the Tagus.

It is hardly necessary to state, that such very advanced Darwinianism as this does not represent the opinion and belief of the great body of students of prehistoric archeology the world over. The writer does not know of six men of science in Europe who accept 'the precursor of man.' The evidence that has sufficed to produce in the author's mind the conviction of his existence must be admitted to be very slight, although this does not appear to disturb him greatly. To the objection that the discovery in a certain locality, of objects that seem to bear traces of human workmanship, has not been confirmed in other places, he replies, that this is "an objection without foundation, since a fact can only be observed at one spot. It is like denying an eclipse because it is only visible upon a small portion of the globe."

We, however, are of the opinion that most students of prehistoric archeology look at the facts of their science in a very different spirit from this. They assert their existence, but wait until a sufficient number has been accumulated before attempting their explanation. Nevertheless, we must do the author the justice of admitting that he has been very severe and critical in his examination of the evidence of these facts, and will only allow its validity in the cases upon which he has founded his three species, rejecting all the many other alleged proofs of the existence of 'the tertiary man.' He largely relies upon the recent discovery by Professor Bellucci of Perugia, in the presence of several witnesses, of a flint flake *in situ* in a deposit alleged to belong to the upper miocene, at a place called the desert of Otta, not far from Lisbon. It would take more space than we have at our command to point out the weakness of this piece of evidence, which has been done elsewhere.[1] We will merely repeat, that "prudent investigators must hesitate to base the proof of a fact pregnant with such startling consequences upon no firmer foundation than a mere 'bulb of percussion.'"

The other disputed point in the new science, upon which the author takes decided ground, is in favor of the so-called 'hiatus' between the paleolithic and the neolithic periods. He believes, not only that a long space of time, during which great changes were effected in the climate and the fauna of Europe, elapsed between the two periods, but that the second is marked by the appearance upon the scene of a new and more advanced race of men, who with better tools and weapons, and aided by a knowledge of the cereals and the use of domesticated animals, gained the mastery over the autochthonous population of the earlier period. The contrary opinion maintains that the later race were developed from the former by a slow and gradual process. For our own part, we agree with the author's conclusion, believing it to be sustained by the preponderance of evidence.

As both a general statement and a minute account of the present state of knowledge in regard to prehistoric subjects, we know of no work superior to this. It is a complete storehouse of information, gathered by a master of the new science, who assisted at its birth, and has dwelt within its very penetralia. His statements in regard to facts can be relied upon most implicitly; it is only to some of his conclusions that we take exception.

[1] International review, September, 1882.

PINNER'S ORGANIC CHEMISTRY.

An introduction to the study of organic chemistry. By ADOLPH PINNER, Ph.D. Translated and revised from the fifth German edition by PETER T. AUSTEN, Ph.D., F.C.S. New York, *John Wiley & Sons*, 1883. 19+403 p. 8°.

CHEMISTS who are already familiar with Professor Pinner's *Repetitorium der (anorganischen und) organischen chemie* need not be informed of the peculiar excellences of that successful text-book, and will welcome Dr. Austen's translation, which makes it available to English-speaking students. This work presents, in a systematic and comprehensive manner, a review of the enormous number of substances derived from carbon, and especially indicates their mutual theoretical relations. Beginning with the compounds of the group C_1, the author describes, first, the simpler bodies, then their hydroxyl-derivatives, sulpho-derivatives, nitrogen-derivatives (amines, amides, urea, cyanides, etc.), phosphorus, arsenic and antimony compounds, and the so-called organo-metallic bodies; next follow the simpler substances of the group C_2, with their derivatives; and so on. The space given to any one body or topic is necessarily small. American students, with their utilitarian views, would probably prefer more descriptive matter in many cases, as in alcohol, sugar, starch, petroleum, etc. Practical matters are made subordinate to theoretical considerations.

The translation is clear and generally satisfactory, but not always free from traces of the original language. The translator follows the rules issued by the London chemical society as respects spelling, arrangement of constitutional formulae, and terminology. The work is exceedingly well printed, and very free from typographical errors. As a compendium of the present actual state of organic chemistry, for use in classes having a good foundation of inorganic chemistry, this work is well adapted, and deserves general acceptance.

REPORT OF THE CONNECTICUT SHELL-FISH COMMISSION, 1883.

Second report of the shell-fish commissioners of the state of Connecticut to the general assembly, January session, 1883. Middletown, *Pelton & King*, 1883. 44 p., map. 8°.

IN natural accordance with the reputation of its inhabitants for sound common sense applied to business matters, the state of Connecticut enjoys the distinction of being the first to appoint a commission to supervise its interests in the fisheries of economic mollusks. The

second report of that commission has just appeared. The most important work upon which the commissioners have been engaged is that of mapping the grounds within the state limits suitable for the cultivation of oysters, and assigning the same to those engaged in that industry, upon the payment of an almost nominal fee. Natural beds, or those which have been so within ten years, are exempted from assignment. The immediate result of this policy is to give to the oystermen a property in the ground they use, protection against encroachment, and security in the possession of improvements thereon. This, in time, will largely increase the yield of this valuable food-supply, and add to the taxable resources of the state. At a time when the beds of the Chesapeake are perilously near a destruction, which, under the present conditions of folly, ignorance, and greed in those most interested, is inevitable, the action of the state of Connecticut assumes a national importance. The work of surveying the coast with the co-operation of the U. S. coast survey has been actively carried on, and in its most important features has been carried out for that part of the shore west from the Connecticut river. By the commencement of the working-season of 1883, it is believed that 90,000 acres of oyster-grounds will be held by cultivators under state jurisdiction. A new mode of cultivation, or capture of spat for seed on muddy bottoms, has been invented at Groton. Birch-trees of fifteen or twenty feet in height, and three or four inches in diameter at the butt, are thrust about three feet into the mud, with the tops under the surface of the lowest water, and inclined at an angle of some 45° with the current. The floating spat attaches itself to the branches, and grows rapidly; a single bush affording, in a few months, five to fifteen bushels of seed-oysters, none of which would have survived settling on the muddy bottom. An absurd claim was made, that these submerged bushes produced scarlet-fever and diphtheria, and many were destroyed; but the plan has recently received legal recognition, and, with proper effort, can be made to produce millions of bushels of oysters where is now only waste ground.

The oyster-business in all its branches has attained greater perfection in Connecticut waters than in any other part of the country. It is usually very profitable, but subject to unexpected and sometimes ruinous losses. Thousands of bushels of oysters have been destroyed on one patch in a week by starfish. A firm is mentioned which in two years, off Charles Island, has lost oysters valued at one hundred thousand dollars. The starfish seem to move in crowds, which scatter when they reach a bed, and devour all before them. One fisherman, while searching for them, came upon an immense bunch, and gathered in seventy-five bushels of starfish in a short time, thus saving his bed. The coot (Fulica atra), it has been discovered, feeds upon young starfish, and its protection is recommended. The drill (Urosalpinx cinereus Stimps.) and periwinkle (Sycotypus canaliculatus Gill), as well as the drumfish, are reported to do but inconsiderable damage, especially in the deeper waters. The pollution of rivers falling into the Sound, the dumping of mud dredged out of harbors, and oyster-thieving, are referred to, and legislative regulations suggested. The propagation of the oyster has been attempted, but thus far with little prospect of success, on account of the extreme minuteness and delicacy of the embryos. Without radical improvement on present methods, this branch of the subject offers no grounds for belief in its practical application to economic purposes. The report contains a map of the triangulation executed, and an appendix of statutes bearing on the general topic.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Comet (Brooks-Swift). — The spectrum of this comet was examined at Lord Crawford's observatory, Dun Echt, Scotland, on the evening of March 1, and found to be fairly bright, and to consist of the usual three bands. — (*Dun Echt circular*, No. 71.) D. P. T. [473

The mass of Jupiter. — In a paper published in the Proceedings of the Royal Swedish academy (1882), Dr. Backlund develops the formulae by which the correction to the mass of Jupiter may be derived from heliometric observations of the distances and position-angles of the satellites *inter se*, and not, as usual, from the planet. He is engaged upon a new determination of this character. The chief advantage in this method is, that measures of the star-like satellites from each other are much less likely to be affected by constant errors than are measures of the satellites from the planet. The number of unknown quantities in his final equations is twelve; six observations, at least, being required in order to obtain all the corrections to the elements. — (*Copernicus*, Feb.) D. P. T. [474

MATHEMATICS.

Complexes of the second degree. — Herr Stahl gives a synthetic treatment of certain points in connection with Kummer's sixteen-nodal quartic surface. The processes are new; but, for the most part, the results are well known. — (*Journ. reine angew. math.*, xciii.) T. C. [475

Rotation of a liquid ellipsoid. — In two articles Mr. Greenhill has examined the conditions to be satisfied in order that a liquid ellipsoid may rotate about an axis other than a principal axis, and have a free surface. The axis of rotation, as stated by Riemann, lies in a principal plane of the ellipsoid. The motion is supposed to be set up in the liquid by mechanical processes; and the pressure at any point is investigated, the liquid being supposed contained in a rigid shell. The conditions are then investigated that are requisite for the ellipsoidal shell to be a surface of equal pressure, and that a free surface can exist. — (*Proc. Cambr. phil. soc.*, 1882.) T. C. [476

Non-Euclidean geometry. — Dr. Story has shown, in a previous paper, how the formulae of a non-Euclidean plane trigonometry could be deduced from those of the Euclidean spherical trigonometry; viz., by the replacement of each side by a constant multiple of that side, and each angle by a constant multiple of that angle. In the present paper he makes the corresponding deduction for any non-Euclidean spherical trigonometry, and also gives a number of formulae relating to distances, areas, etc. A new and important principle is exhibited; viz., *the distance (or angle) between any two geometrical elements (points, planes, or straight lines) is, to a constant factor près, the same, in whatever way it is measured.* For example, the formulae show that the distance of a given point from the nearest point in a given plane is proportional to the angle between the given plane and the nearest plane through the point (i.e., that which makes the least angle with it); the least (or greatest) distance from a point of one of two given straight lines to a point of the other is proportional to the least (or greatest) angle which a plane through one of the straight lines makes with a plane through the other; and, if the lines intersect, this is proportional to the angle between the lines, etc. Expressions are given for the circumference and area of any circle, the area of any spherical polygon, the surface and volume of any sphere; it is also shown that the double plane is identical with a sphere of *quasi*-infinite radius. A further abstract will be given on the completion of the paper. — (*Amer. journ. math.*, v.) T. C. [477

PHYSICS.

Acoustics.

Vibratory movement of bells. — Mathieu has recently studied the vibrations of bells, with a preliminary investigation of the vibrations of bent bars, considering the case of an ordinary bell in which the thickness in any meridian increases from summit to base. Between the vibratory movement of a bell and that of a plane plate, the essential difference exists, that, while in the latter the longitudinal or tangential movement and the transverse movement are given by independent equations, in the former, the normal and tangential motions are given by three equations which are not independent. The pitch of the notes of a bell does not change if the thickness varies in the same relation throughout every part: since the terms depending on the square of the thickness may be neglected; at least, for the graver partials. It is impossible to construct a bell so that it shall vibrate only normally; and, with a hammer, the tangential vibrations are of the same order as the normal vibrations. A purely tangential motion can be realized only with a spherical bell of constant thickness. — (*Journ. de phys.*, Jan.) C. R. C. [478

Vibrations of solid bodies in contact with liquids. — F. Auerbach has investigated the effect of liquid contained in a glass vessel upon the pitch of the sound produced when the latter is set into vibration. He reaches the following results: 1. The geometrical lowering in pitch (ratio of number of vibrations), produced by a liquid contained in a cylindrical glass completely filled by it, is less in proportion as the pitch of the empty glass is higher. 2. The arithmetical lowering of pitch with a cylindrical glass of mean pitch is approximately proportional to the reciprocal of the square root of the number of vibrations of the empty glass. 3. The lowering of pitch, when the glass is completely filled, is not noticeably dependent on its height. 4. The geometrical lowering of pitch produced in cylindrical glasses of different widths is greater in proportion as the glass is narrower. 5. The arithmetical lowering of pitch with cylinders of different widths is inversely as the square root of the width. 6. The arithmetical change of pitch is inversely proportional to the square root of the number of wave-lengths of the sound given by the empty glass contained between the walls and axis of the cylinder. 7. The lowering of pitch is greater as the density of the liquid is greater. 8. It is greater in proportion as the compressibility of the liquid is less. — (*Ann. phys. chem.*, 1882, xiii.) C. R. C. [479

Optics.

(Photometry.)

Solar photometry. — M. A. Crova has recently made some comparisons of the relative brilliancy of the sun and of a Carcel lamp. He compared the lighting-power of different wave-lengths in the two spectra, thereby deducing curves for each. The areas enclosed by these curves then represented the total amount of light given out by each source. He then deduced the factor by which it was necessary to multiply the smaller ordinates in order to render the two areas equal. The ordinate of intersection of the two curves of the same area then furnished at once the wave-length whose photometric comparison would give the ratio of the total light emitted by the two sources. This wave-length (582) is situated in the yellowish-green, and may be isolated by transmitting the light through a mixture of the solutions of perchloride of iron and chloride of nickel. The two lights thus obtained were of precisely the same color, and their ratio was at once determined by measurement with a Foucault photometer. After making all corrections, this method gives about 60,000 carcels (600,000 candles). — (*Comptes rendus*, Dec. 18, 1882.) W. H. P. [480

Electricity.

Electric amalgamation. — In the process of obtaining gold by amalgamation from ores containing arsenic and certain other impurities, the mercury 'sickens,' and fails to take up all the gold present. Mr. Richard Barker has devised a method of amalgamation which has given very satisfactory results. The inclined table over which the ore is washed contains hollows filled with mercury; over these, in the water containing the washings, copper wires are introduced, and brought so near that a powerful current may be passed to the mercury, which seems to gather itself away from the impurities, and to act more energetically upon the ore. — (*Iron*, Feb. 9.) J. T. [481

Relation between viscosity and galvanic resistance. — Mr. L. Grossman applies formulas deduced by him in a former article (*Ann. phys. chem.*, 1882, xvi.) to the analysis of experiments made by Grotrian, Kohlrausch, and others, on the temperature curves of internal friction and galvanic resistance in fluids, obtaining what he considers accurate determinations of twenty-five temperature co-efficients for each of these properties in solutions of six different salts; hence he concludes, that, for these solutions, the temperature curves of these two properties are equal. — (*Ann. phys. chem.*, 1883, i.) J. T. [482

Molecular theory of magnetization. — D. E. Hughes, in a lecture before the Institution of mechanical engineers, says that if a coil be placed at right angles with a plane circuit containing a soft iron wire, which passes through the centre of the coil, torsion of the wire induces currents in the coil which are reversible with the direction of torsion, but independent of its amount. A steel core does not respond in this way to torsion: hence, by analogy of the effects produced by inclining the core to the plane of the coil, the lecturer argues a greater molecular rigidity in steel than in iron. Attention was called to the fact that the coercive power of iron is greater than that of steel if the inducing forces are 'within the range of iron.' Iron, on being twisted or subjected to longitudinal vibration, lost its magnetism, steel did not. The magnetic properties of iron were illustrated by a glass tube containing iron filings, which lost its residual magnetism on being shaken or carefully rotated. The greater molecular rigidity of iron alloys was compared to the properties of the tube when petroleum was poured in among the iron filings, greater coercive power being thus attained. These facts go to support the theory that steel is an alloy of iron and carbon. — (*Iron*, Feb. 2.) J. T. [483

ENGINEERING.

Stability of brick conduits. — Mr. A. Fteley contrasted the theory on which the designing of brick conduits is based with the actual conditions under which such structures are built. Sewers and conduits are often built in ground more or less yielding, and the action of the earth about them is an important element of their stability. Under such conditions, such structures must move more or less after being built, and the conditions of stability must be very different from what they appear to be from a study of the original drawing. A study of the changes of form, by means of exact measurements made during construction, might point to defects due to the design or mode of construction, to the ground in which the sewer or conduit is built, or to the want of care or skill in the builder.

The author presented a diagram of an apparatus, showing, *in full size on a section drawn at a small scale*, all the deviations of the brick-work from the true line of section. The exaggerated distortion of the outline defines very clearly the slightest defects in construction or the movement of the structure. Diagrams were exhibited showing distortions in a conduit nine feet in width and seven feet eight inches high, and were taken at points where the conduit was built in firm, dry ground, in yielding ground, in wet trenches, on platforms in swampy land, and on high artificial embankments. From these diagrams and the distortions they exhibited, the defects in construction and design, in different locations and under different loads, were explained. The tendencies of the structure to spread under different conditions was alluded to; also the section of excavation in yielding ground best suited to prevent movement.

An instance of the successful underpinning of a brick conduit was described. A large quantity of water broke in between the outside of the brick-work and the sheet-piling supporting the trench, and washed away the sand forming the foundation for a length of about thirty feet, leaving it without support for that distance. A very simple and efficient means was described by which this space was filled with a grout of Portland cement. — (*Bost. soc. civ. eng.; meeting* Feb. 21.) [484

Steel castings. — M. A. Pourcel described recently, before the Iron and steel institute of Vienna, a series of experiments upon steel castings. He stated that the chief points to which attention is now directed are, increase in the size of the castings, and improvements in the methods of annealing and tempering in order to endue the casting with the highest mechanical qualities corresponding to the chemical composition. The last progressive step was the casting of cylinders for a Paris firm, 2.04 m. in diameter, over 2 m. long, and 55 mm. thick. These cylinders supported a pressure of forty-five atmospheres without showing signs of percolation. — (*Engineering*, Dec. 8, 1882.) G. A. H. [485

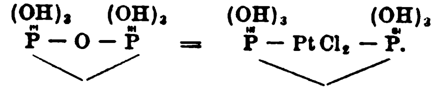
Screw-propeller blades. — The use of manganese bronze as a material for screw-propeller blades is rapidly extending. The first run of the 'Alaska' from Queenstown to New York in less than seven days was made immediately after her steel blades had been replaced by blades of manganese bronze. The great qualities of manganese bronze are its strength, and its freedom from corrosion. Recent experiments show that it has a transverse strength about double that of gun metal, and also, up to the elastic limit, double that of steel. The cost of manganese bronze is about double that of steel; but it is claimed that propeller-blades made of the bronze will last during the lifetime of the vessel, while steel blades require renewal every three years. — (*Engineering*, Jan. 5.) G. A. H. [486

CHEMISTRY.

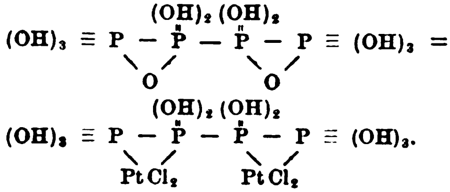
(General, physical, and inorganic.)

Formation of carbonic oxide. — Dr. L. P. Kinnicutt suggested a modification of Noack's method (*Berichte deutsch. chem. gesellsch.*, xvi. 75) for the preparation of carbonic oxide. He found that this gas was freely evolved when magnesia alba was heated in a retort with zinc-dust, and that it contained a small percentage of carbonic dioxide. — (*Harvard chem. club; meeting* March 13.) [487

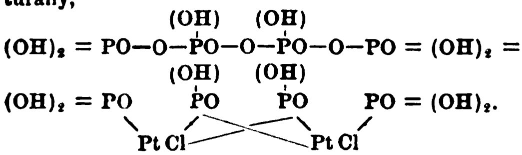
On the probable existence of new acids containing phosphorus. — Concerning the replacement of oxygen by platinous chloride in certain forms of phosphoric acid, Prof. W. Gibbs made the following suggestions: "Schützenberger described, some years since, a remarkable series of compounds in which platinous chloride ($PtCl_2$) replaces a molecule of chlorine or an atom of oxygen. Thus we have $PCl_3 . PtCl_2$ chemically equivalent to PCl_5. The corresponding acid is $P . PtCl_2 . (OH)_3$, which may be regarded as a derivative of $PO(OH)_3$. The same chemist obtained three other analogous acids, having respectively the formulas $P_2 . PtCl_2 . (OH)_6$ (corresponding to the chloride $2PCl_3 . PtCl_2$), $P_2 . PtCl_2 . (OH)_5$, and $P_2O_2 . PtCl . (OH)_3$. In all these cases we have the chemical equivalence $PtCl_2 = 2Cl = O$. Hence, following up the relation suggested by the equivalence expressed by $P . PtCl_2 . (OH)_3 = P . O . (OH)_3$, it seems at least probable that there are modifications of phosphoric acid expressed by the structural formulas, —



The formula $P_2 . PtCl_2 . (OH)_5$ is structurally unsymmetric, and must be doubled; so that we have $P_4 . 2PtCl_2 . (OH)_{10}$, or



Finally, in the acid $P_2O_2 . PtCl . (OH)_3$, we have $PtCl = 3Cl$, and therefore $2PtCl = 3O$. Hence, doubling, we have $P_4O_4 . O_3 . (OH)_6$, and, structurally,



It is easy to see that in the last four acids we may expect to find a marked influence of *position*, depending upon the different modes of union of the hydroxyl." — (*Harvard chem. club; meeting* March 13.) [488

METALLURGY.

Action of sunlight upon silver amalgamation. — By the process as usually conducted, native sulphide of silver is converted into chloride by treatment with mixed sulphate of copper and common salt. The chloride so formed is decomposed and amalgamated by mercury. M. P. Laur, of Rodez, has investigated this matter in the laboratory. In a glass vessel he placed a solution of common salt and sulphate of copper; a porous vessel filled with mercury was suspended in it, and a platinum electrode dipped into the mercury; the second electrode was a leaf of sulphide of silver, and was dipped into the copper solution. The electrodes were connected with a galvanometer, and the needle was found to swing according to the intensity of the light. The cupric chloride was changed by the mercury to cuprous chloride; and the latter acted upon the silver sulphide only in the presence of sunlight. — (*Iron*, Dec. 22, 1882.) R. H. R. [489

Petroleum as a blast-furnace fuel. — E. W. Shippen, of Meadville, recently built a small blast-furnace for testing petroleum. The furnace was 35 ft. high, 8 ft. hearth, 5 ft. bosh. It was fired with dried wood, iron-ore, and limestone. Hot oil was injected at the tuyeres under 16 lbs. pressure in the form of a spray. The white-hot charcoal, when struck by the hot oil, turned as black as if cold water had been thrown upon it. The experiment does not appear to have been a success. — (*Iron*, Dec. 29, 1882.) R. H. R. [490

Aluminum. — A recent patent by Mr. Morris of Uddington, N.B., claims to have solved a problem which has long baffled the skill of technical chemists. By heating an intimate mixture of alumina and charcoal in a current of carbon dioxide, Mr. Morris says that metallic aluminum is produced. The metal is purified from carbon and alumina by a second fusion. — (*Nature*, Dec. 21, 1882.) R. H. R. [491

GEOLOGY.

Lithology.

Crystals of serpentine. — Professor H. C. Lewis called attention to some interesting crystals of serpentine which occur in deweylite from Way's felspar quarry, Delaware. The crystals have a gray color, a pearly lustre, and an eminent basal cleavage almost micaceous. They polarize light, and are optically biaxial with a small axial angle, being probably orthorhombic. The blowpipe examination and analysis proved the mineral to have the composition of serpentine. The deweylite contains rounded masses of felspar partially altered into deweylite, together with sharp cleavage fragments of quartz, such as would be produced by throwing a heated crystal of quartz into cold water. The micaceous serpentine was the result of the alteration of mica, but, being crystallized, was not a true pseudomorph. The two points to which he desired to call special attention were the occurrence of serpentine in the crystallized state, and the direct alteration of graphic granite into magnesian minerals. — (*Acad. nat. sc. Philad.; meeting* March 13.) [492

MINERALOGY.

Bournonite. — A mineral resembling tetrahedrite, from Park county, Col., analyzed by W. T. Page, agreed essentially in composition with bournonite, and can be regarded as a variety in which most of the lead has been replaced by copper and zinc. — (*Chem. news*, xlvi. 215.) S. L. P. [493

Dopplerite. — Very carefully selected material of this organic mineral from Aussee, in Styria, has been investigated by W. Demel. He shows that the ash consists mostly of oxide of calcium, which is in chemical combination with the organic substance. The composition of the whole cannot be expressed by a simple formula; but the organic part is of an acid nature, agreeing with the formula $C_{12}H_{14}O_6$. — (*Berl. berichte*, xv. 2961.) S. L. P. [494

Native iron. — Small grains of iron accompanying gold from the gold-washings in Brush creek, Montgomery county Va., have been analyzed by W. T. Page. Absence of cobalt and nickel shows that they are probably not of meteoric origin; and evidence is given that they are grains of native iron, and not derived from the tools of workmen. Similar grains have also been separated and analyzed from auriferous sand from Burke county, N.C. — (*Chem. news*, xlvi. 205.) S. L. P. [495

Fergusonite. — This mineral, in fragments of tetragonal crystals from Burke county, N.C., has been analyzed by W. H. Seamon. From the analysis he derives the ortho-niobate formula $R''' Nb O_4$. — (*Chem. news*, xlvi. 205.) S. L. P. [496

Orthite. — This mineral from Mitchel county, N.C., occurring in flattened crystals, has been analyzed by W. H. Seamon. The results of analysis showed a very small content of the cerium metals and a large quantity of calcium oxide. The formula derived was that of an ortho-silicate. — (*Chem. news*, xlvi. 215.) S. L. P. [497

Mimetite. — Colorless crystals of this mineral from Eureka, Nev., gave F. A. Marsie, upon analysis, the usual formula, $3\ Pb_3As_2O_8,\ PbCl_2$. — (*Chem. news*, xlvi. 215.) S. L. P. [498

METEOROLOGY.

Barometric laws. — An important contribution to this branch of meteorology has been made by Dr. Köppen of the Deutsche seewarte. Reviewing the work of Ley, as expressed by him in the eleven pos-

tulates published in 'The laws of the winds prevailing in western Europe,' he claims that three of these have been shown to be incorrect, while the others are confirmed. For these three he would substitute the following: "Mountainous regions, in spite of the copiousness of their rains, are visited by centres of depression more rarely than the surrounding lowlands and seas, — in general, there is not wholly wanting some influence of precipitation upon the depression; but this influence is not yet clearly defined, and in any case is but indirect."

Recent meteorological investigations justify the enunciation of four new theorems, which the author gives as follows: 1°. The direction of air-currents, in our latitudes, at the distance of from 500 to 3,500 metres from the earth's surface, is, on the average, nearly parallel to the isobars of that layer; in the lowest stratum it deviates from 0 to 8 points towards the side of the lower pressure, and, in the layer from 3,500 to 9,000 metres from the earth, from 0 to 2 points towards the side of the higher pressure, from the isobars of the respective layer. 2°. Since the pressure decreases with the altitude more slowly in warm than in cold air, the gradients, independent of their ratio to the pressure, are changed, as we ascend, in such a manner that an excess of pressure exists upon the side of the warmer air-columns. 3°. The advance of the depressions takes place approximately in the direction of that air-current, within it and approaching its path, which has a preponderance of accumulated energy. 4°. Since the conditions of motion at different heights of the vortex are different, there is required for its onward movement, not the state of motion of the lowest layer, but that of the sum total of layers. As the changes are continuous with the height, the state of motion of a certain mean layer, whose height is still to be determined, can in general be substituted for it. In support of these propositions, the author refers in detail to the works published in recent years by Terrel, Hann, Guldberg, Mohn, and others, and thus incorporates the results of the leading meteorologists of the present day. — (*Ann. hydr. und marit. meteor.*, 1882, heft xi.) W. U. [499

Pressure of the wind. — An apparatus for measuring the pressure of the wind, which promises good results, is suggested by Dr. Sprung of Hamburg. It consists essentially of a hollow metallic sphere erected upon the top of a long rod, which is suspended at a point just above the centre of gravity of the apparatus. Pressure upon the ball is communicated to the rod, and may be recorded by a suitable registering-cylinder. — (*Repert. exp. phys.*, xviii. heft 12.) W. U. [500

PHYSICAL GEOGRAPHY.

Australia. — The physical structure and geology of Australia is well summarized by Rev. J. E. Tenison-Woods. The southern side is low, or bounded by cliffs three hundred to six hundred feet high; the west is a tableland about a thousand feet in height; the north is a little higher; and the east averages two thousand feet elevation, and, near the south-eastern angle, bears the Australian Alps, with summits from six thousand to seven thousand feet. The interior depression is eccentrically placed near these mountains, and from them the slopes are sufficient to form the only large river-system of the continent. Elsewhere, whatever rain falls on the interior plains soon collects in shallow marshes, which are generally salt. Granite occupies most of the border-tablelands, but is sometimes replaced by vertical paleozoic or older slates and schists. These remain from a very ancient disturbance which had no connection with the present outline of Australia, and are at places overlaid by mesozoic strata. The great depression contains cretaceous strata, overlaid along the southern shore by a full series of marine tertiary deposits reaching three or four hundred miles inland, and as much as six hundred feet above sea-level. About contemporaneous with their rapid uplift a subsidence occurred, forming the castellated fiords and diversified scenery of Port Jackson, Broken Bay, etc. Extensive volcanic overflows are common nearly all around the tableland, and generally determine the direction of modern drainage. Their date is mostly miocene; but west of Melbourne they are much more recent, and ash cones and craters are frequently preserved. There are also scattered isolated masses of cross-bedded sandstone, forming flat-topped mountains, bordered by precipitous cliffs, so characteristic of Australian scenery. These are ranked as tertiary, or older eolian deposits, and are sometimes a thousand feet thick. Other land-formations are the tertiary drifts — often containing gold from the disintegration of the Cambrian and Silurian rocks, and sometimes buried under heavy lava-flows — and the recent sands and clays of the level half-desert regions derived from the weathered granite, covering a great part of the country. The sand lies in ridges, separated by the yellow clay flats, which a little rain makes very boggy.

The narrow strip of land between the plateau and the sea is generally well enough watered by streams to possess fertile alluvial plains, occupying most of its area. On higher ground the volcanic rocks, fortunately of considerable extension, yield the best soils. The colony of Victoria has the greatest share of these. Farther inland the lands are, as a rule, poor, except in river-valleys; and toward the central basin of the continent they are desert, like the Sahara. There seems to be good probability that artesian wells may be sunk here successfully. This is indicated by the occurrence of springs within the central depressed area. Their water is warm, indicating a deep source, and a supply from the slopes of the surrounding tableland. They form travertine deposits, in which the remains of gigantic marsupials are found. The paleontological evidence of the age of the several formations above named is given with some detail. — (*Proc. Linn. soc. N. S. Wales*, vii. 1882, 371.) W. M. D. [501

Physical features of the Australian Alps. — A paper with this title, by J. Stirling, gives some introductory particulars of this range, about lat. 37° S., preparatory to further account of its geology and botany. Its culminating peak is Mount Kosciusko (7,256 feet), with companions in Mounts Bogong (6,508), Feathertop (6,308), and Hotham (6,100). These carry snow-patches through the summer. Below them are numerous plains at altitudes from 3,000 to 6,000 feet, possessing distinctly alpine features. In midsummer (February), when the lower valleys are languishing in excessive dryness, the rich volcanic soil of these flat highlands bears a luxuriant growth of alpine flowers and snow-grasses, giving excellent pasturage. During the rest of the year their climate is inhospitable, having sudden changes, severe frosts, and heavy snows. The present dividing-range is not regarded as the original axis of elevation, but has assumed its form by the erosion of a great miocene highland north and south of it, now remaining as isolated peaks, — Wills, Gibbo, Bindi, Baldhead, and others. The basis of this plateau is of crystalline schists and Silurian strata, overlaid by deposits containing miocene plants capped with basaltic flows, into all of which the rivers have cut

deep gorges. The rain, brought by southerly winds, was 58.59 inches on 154 days in 1880 at Grant (3,700 feet above sea-level in the basin of Mitchell River, south of the dividing-range), and 29.92 inches on 114 days in the same year at Omeo (2,108, altitude north of the range). The article is chiefly devoted to the detailed topography of the Mitta Mitta basin north of the divide. — (*Trans. roy. soc. Victoria*, xviii. 1882, 98.) W. M. D. [502

GEOGRAPHY.

(*Asia.*)

Northern Persia. — A plane-table route survey from Tehran to Astrabad, by Lieut.-Col. Beresford Lovett, British consul at the latter place, gives a considerable addition to the knowledge of the topography of that region. His way led generally along the northern slope of the Elbruz mountains, continually crossing over passes between valleys opening northward to the Caspian. Notes are given on the altitudes, distances, and roads between stopping-places; the character of the towns, and the supplies they afford; and very briefly on the appearance and structure of the country. On nearing Astrabad, the northern mountain slopes were found covered with luxuriant forests of elms, oaks, and beeches; but, on crossing the Shahwar mountains, on a second trip south-east from Astrabad to Shahrud, the country was found very dry and barren. At other points it was noticed that the moist winds from the Caspian formed clouds only on the northern sides of the mountain-ranges. It was found that the plains of the Lar (Harhaz) river, south-west of the great volcano Demavend, were formed as lake-beds during a time when lava-flows south of the volcano held back the river. A gorge has since been cut through the barrier, so that the lake has now disappeared. No granite or 'trap rock' was seen. The mountain summits were of compact limestone; and the valleys showed marls, sandstones, and shales. A geological section of very doubtful value is given of the mountains south of Astrabad. — (*Proc. roy. geogr. soc.*, 1883, 57; map.) W. M. D. [503

Eastern Turkestan. — This region was visited from India by Shaw in 1872, who was well received by the local authorities, and found good opportunities for trade; but further attempts at intercourse were stopped by the Mohammedan rebellion under Yakub Beg (Atalik Ghazi) against the Chinese. While this movement was successful, Sir Douglas Forsythe's mission crossed the mountains, and again found encouragement for commercial enterprise. A second interruption came on the defeat and death of Yakub Beg, and the reconquest of eastern Turkestan by the Chinese. Two years ago Ney Elias, British resident at Leh in Ladak, made the same trip, and met with no opposition. Lastly, Mr. A. Dalgleish, a merchant in India, conducted a trading-caravan across the mountains, and staid ten months in Kashgar, where he was well received, and successfully disposed of his goods. He has lately returned, and proposes to go again. — (*Athenaeum*, Feb. 10.) W. M. D. [504

Tibet and the Sanpo. — One of the pundits trained for trans-Himalayan exploration has lately returned to India, with all his journals and instruments, after an absence of four years, in spite of the report, previously received, that his legs had been broken to prevent his further travels, and that his companion had been executed by the authorities at Lhassa. He was twice robbed of nearly all his property, and was twice forced to work for his support; but he took many observations for latitude, and recorded much of his route. After leaving Lhassa, the attempt was made to reach Lob-nor (Prejevalsky had not then been there). The farthest points reached were Saithang and Saitu (lat. 40°, long. 92°), thus failing of the object only by a comparatively short distance. On returning, he went to Batang, and desired to cross into Assam, but turned back, as savage tribes were reported on the frontier, and went westward toward Lhassa, stopping short of this place, however, for fear of being recognized there, and crossing the Sanpo at Tchetang. Gen. Walker, of the Indian survey, regards the route followed from Batang as giving good evidence that the Sanpo does not join the Irawadi: for, if it did, the pundit must have crossed it three times; while he is confident that he crossed it only once, and that a great range of hills cuts it off from the rivers on the east. — (*Proc. roy. geogr. soc.*, 1883, 99.) W. M. D. [505

(*Pacific Ocean.*)

Arctic currents. — Professor Davidson read a paper, prepared by Capt. Hooper, who commanded the 'Corwin' in the Arctic, upon the currents determined in his last cruise in Bering Sea, Bering Strait, and the Arctic Ocean south of Herald Island. The data were abstracted from the records of the vessel, and demonstrated the prevalence of a current setting through the Bering Strait to the Arctic. The observations were specially directed to this point; and Capt. Hooper's experience of the previous year, and his appreciation of the difficulties attending the question, add special value to his deductions on this question. The president recalled the results of former observations, weighing their relative values, and gave the fullest credit to the 'Corwin's' work. — (*Proc. Calif. acad. sc.; meeting* March 5.) [506

BOTANY.

Freezing of liquids in living vegetable tissue. — Mr. Thomas Meehan referred to the prevalent opinion that the liquid in vegetable tissues congeals as ordinary liquids do, and, expanding, often causes trees to burst with an explosive sound. Experiments on young and vigorous trees varying from one foot to three feet in diameter demonstrated that in no instance was there the slightest tendency to expansion; while, in the case of a large maple (Acer dasycarpum) three feet eleven inches and a half in circumference, there appeared to be a contraction of an eighth of an inch. In dead wood soaked with water there was an evident expansion; and the cleavage with explosion, noted in the case of forest-trees in high northern regions, may result from the freezing of liquid in the centre or less vital parts of the trunks. In some hardy succulents, however, instead of expansion under frost, there was a marked contraction. The joints or sections of stem in Opuntia Rafinesquei and allied species shrink remarkably with the lowering of the temperature, so that the whole surface in winter is very much wrinkled. Assuming as a fact that the liquids in plants which are known to endure frost without injury did not congeal, it might be a question as to what power enabled this successful resistance. It was probably a vital power; for the sap of plants, after it was drawn from them, congealed easily. In the large maple-tree already referred to, the juices not solidified in the tree exude from the wounded portion, and then freeze, hanging from the trees as icicles, often six inches long. — (*Acad. nat. sc. Philad.; meeting bot. sect.*, March 13.) [507

Autoxidation in living vegetable cells. — Traube has given the name '*autoxydable körper*,' or, as we must clumsily translate the new term, autoxidizable substances, to those bodies which, at a low

temperature, and by the action of free, passive oxygen, can be oxidized, forming, in the presence of water, peroxide of hydrogen. Starting from Traube's statement of the changes which accompany oxidation, especially the formation of peroxide of hydrogen, Prof. Reinke gives the following as a sufficient basis on which to build a theory of oxidation in living cells. (He has himself shown that there exists in certain plants, notably in the beet, a very easily oxidizable body, which he has named rhodogen. This substance is one of Traube's autoxidizable bodies, and is only one of many which may be reasonably assumed to be present in cells.)

1. In every active cell, autoxidators are formed; that is, substances which, at a low temperature, and by the action of molecular oxygen, can be oxidized in the presence of water.

2. By oxidation of these substances, peroxide of hydrogen is produced.

3. This peroxide of hydrogen can, under the influence of diastase, and probably of other ferments, cause further oxidations, just as atomic oxygen can.

Lastly, the seat of this activity is the periphery of the protoplasmic body of the cell; and this body possesses an alkaline reaction. — (*Bot. zeit.*, Feb. 2 and 9, 1883.) G. L. G. [508

Structures which favor cross-fertilization in certain plants. — Several are made known and discussed by Trelease. The protogyny, development of the anthers one after the other, and usual cross-fertilization by the jostling of the little plants caused by surface-currents of the water, are well made out. The singular arrangement in Hakea and other Proteaceae is worked out with new particulars; also a curious explosive arrangement in certain heaths, a new study of Salvia, and some remarkable arrangements in two Acanthaceous flowers, in one of which a slow change of position, in the other an irritable movement, insures cross-fertilization. The flowers were studied at the Botanic garden, Cambridge. — (*Proc. Bost. soc. nat. hist.*, March, 1882.) A. G. [509

(*Fossil plants.*)

Fossil wood from India. — Prof. A. Schenck enumerates the specimens of fossil wood collected in the East Indies by the brothers Schlagintweit. The greater number of these specimens, twenty, pertain to gymnospermous trees; one species represented by six specimens being identified as Nicolia aegyptiaca, Ung., which was originally described from the wood of the fossil forest of Egypt. Of the other specimens five are conifers, and two monocotyledonous, — palms. Of the conifers four specimens are described under the name of Araucaroxylon Robertianum, the other as Cedroxylon Hermanni. The two specimens of palms represent different species. — (*Engler's bot. jahrb.*, iii. 353.) L. L. [510

Cotta's species of Perfossus. — Prof. A. Schenk records the result of his researches on the original specimens, which Cotta had compared or referred to palms from the distribution of the fragments of fossil wood in the tertiary. The specimens do not appear to have been critically examined since Cotta, the names only being changed: Perfossus angularis, Ung. and Stenzel, for Perfossus; and Palmantes perfossus, Schimper, for Fasciculites perfossus. Perfossus costatus, Cotta, has not been mentioned by Schimper and Stenzel; Unger refers it to corals. From the researches of Prof. Schenk, it appears that the specimens from which Perfossus punctatus has been constituted by Cotta, represent two different species, — Stenzelia elegans, Goepp. (medullosa, Cotta) of the Cycadeae, and a species of palm, probably of the genus Phoenix. — (*Engler's bot. jahrb.*, iii. 484.) L. L. [511

ZOÖLOGY.

Coelenterates.

Peculiar method of budding in the Campanularidae. — The well-known tendency shown by certain hydroids, when kept in confinement, to throw out long tubular processes, which may subsequently become the foundations of new communities, is described in detail by Dr. Lendenfeld as exhibited in Campanularia and Gonothyraea. — (*Zool. anz.*, No. 130.) W. K. B. [512

Observations on Australian hydroids. — Dr. Lendenfeld writes that he has independently discovered in Australian Campanularidae the glandular ring which has been described in Eudendrium by Weissman and Jickeli. He has also verified the existence of Jickeli's 'ganglion-cells;' and he finds similar cells in the endodermal lining of the proboscis, where they are very numerous. The processes which they give off anastomose with each other so as to build up a definite 'nerve-ring' around the mouth. Lendenfeld regards this as the true central nervous system of hydroids. If these star-shaped corpuscles of hydroids are really nerve-cells, we have in these animals a central nervous system which is endodermal in its origin, and which is not homologous with the nerve-ring of the hydro-medusae. In the Campanularidae the endodermal ganglion-cells of the proboscis are joined to sensory cells, each of which carries a sensory hair projecting into the digestive cavity. — (*Zool. anz.*, No. 131.) W. K. B. [513

Mollusks.

Soft parts of Ammonites. — At the November meeting of the Liverpool geological association, a paper on Ammonites and the Aptychus was read by Mr. F. P. Marrat. That gentleman, after reviewing the subject as treated by others, concluded that it is probable that some species of Ammonites, perhaps those protected by a deep-water habitat, were destitute of these appendages, while others, perhaps littoral in their range, and more subject to attacks from predacious enemies, were provided with them. He considers them as opercular attachments to a 'hood' such as exists in Nautilus. Both calcareous and horny Aptychi have been found *in situ*. They are generally smooth or slightly striated; but in the Free public museum of Liverpool is a very fine example, from the lithographic slate of Solenhofen, with a distinctly granular surface, recalling that of the thick, granular hood of Nautilus. The appearance of the edges of the valves in this specimen, beautifully preserved, indicates that its margin was not free, as in gastropod opercula, but that it was partly imbedded in a cartilaginous lobe which fitted the margin of the aperture like the wavy margin of the hood in Nautilus. In this view the hypothesis that Ammonites were internal shells, like Spirula, would seem to be quite untenable, as no internal shell is known which has any opercular apparatus. — W. H. D. [514

Crustaceans.

Heterogenesis in Copepoda. — Under this title, C. L. Herrick, after calling attention to the wide geographical range of some species of Copepoda, and giving instances of species common to the fresh waters of Europe and North America, describes forms of Cyclops and Diaptomus apparently due to abundance of food, and other conditions of environment. In another note the same author refers to a blind non-

parasitic copepod, which he refers to the genus Braydia. — (*Amer. nat.*, Feb., 1883.) S. I. S. [515

Supposed larva of Limulus. — In his letters from the Challenger, the late Dr. von Willemoes-Suhm referred to a larva taken in the East Indies, supposed to be that of Limulus, but which he is said to have concluded afterwards to be the larva of some cirriped. Willemoes-Suhm's original figures and description of the larva are now published with a brief preface by E. Ray Lankester. The figures show that the later conclusion was undoubtedly correct, though the larva is very different from any cirriped larva previously figured. — (*Quart. journ. microsc. sc.*, Jan., 1883.) S. I. S. [516

Insects.

Sexual dimorphism in Psocidae and their salivary glands. — Besides the doubtful case mentioned by Westwood (Lachesilla), no instance of sexual dimorphism has so far been noted in the Psocidae. Bertkau now describes Psocus heteromorphus, in which the female has very rudimentary wings, while the male has wings longer than the body. Two new genera, Trocticus and Lapithes, are described and figured in the same paper. Kolbe, however, a few months earlier, described P. heteromorphus as Neopsocus rhenanus, and Lapithes as Bertkauia. — (*Katter's ent. nachr.*; *Arch. f. naturg.*, xlix. 97; *Herbstversamml. naturh. ver. Bonn*, 1882.)

In the latter place Bertkau also discusses Burgess's so-called 'lingual glands' of Psocus and Atropos, regarding them simply as strongly chitinized areas of the mouth-cavity, possibly serving as salivary accumulators. Bertkau succeeded in finding in Psocus the true salivary glands, which Burgess, in alcoholic specimens, could not demonstrate. There are two pairs of them, each pair with a common duct. No figures are given; and the short notice does not seem to settle satisfactorily either the nature or the structure of the peculiar organs in question. — E. B. [517

VERTEBRATES.

Fatigue and nutrition of the heart. — Gaule has shown that a frog's heart, washed out with dilute solution of common salt until it ceases to beat, is rendered capable of further pulsation when dilute alkaline solutions are sent through it. Martius confirms this, but dissents from Gaule's view, that the alkali nourishes the heart. Its administration leads to a certain number of beats; but these soon cease, and a fresh supply of alkali is then inefficient, while other liquids, especially blood serum, lead to renewed cardiac contractions. Martius concludes that the frog's heart-muscle has in itself no store of energy-yielding material which it can call upon, but works at the expense of food-matters yielded it constantly by the liquid circulating through it. When the heart, irrigated with salt solution, ceases to beat, this is due to the saturation of its tissue with carbon dioxide while still some nutrient matter (blood) remains not washed out from the ventricular network. The salt solution, acting merely as a medium for physical diffusion, cannot remove the carbon dioxide as fast as it accumulates, and consequently the heart ceases to beat while it still has some available food. The alkali, on the other hand, chemically removes the injurious carbon dioxide; and the heart beats for a short time, using the food-stuff in the blood still present in its meshes. When the heart, treated with dilute alkali, ceased to beat, new pulsations could only be obtained when it was supplied with liquids containing serum albumen. Solutions of syntonin, glycogen, peptone, egg-albumen, casein, or myosin, were useless. Gaule had found solution of peptone efficacious. This Martius thinks must have been due to the fact that Gaule used an alkaline solution of that substance, and that the alkali was the efficient element in the liquid. — (*Du Bois' arch.*, 1882, 543.) H. N. M. [518

Influence of different blood-constituents on the beat of the heart. — Ringer withdraws his previous paper (*Journ. of physiol.*, iii.) on this subject in consequence of his discovery that the sodium-chloride solution with which he worked was not prepared, as he had believed, with distilled water. It was made with water supplied by the New river company of London, and containing salts, not only of sodium, but of calcium, magnesium, and potassium. When solution of Na Cl in pure distilled water was used, the results previously obtained failed to appear. On the other hand, the rounding of the apex of the curve of ventricular contraction, the prolongation of the curve, and the slow diastole previously described as due to sodium chloride, are all brought about by solutions of minute quantities of calcium salts in distilled water. A very minute quantity of potassium chloride prevents this effect of the lime-salts. A solution of Na Cl, K Cl, and $Ca Cl_2$ in distilled water is perfectly neutral, yet makes an excellent artificial circulating liquid for the frog's heart. This shows that alkalinity of the circulating medium is not necessary for contractibility. A lime-salt, the author concludes, is necessary for the manifestation of cardiac contractility; but, in the absence of potassium, calcium so prolongs the diastole as to lead to fusion of the beats, and imperfect action of the heart. Sodium bicarbonate cannot take the place of the lime-salts in maintaining the beat of the heart. — (*Journ. of physiol.*, iv. 291.) H. N. M. [519

Fish.

A remarkable deep-sea fish type. — A fish exhibiting a most remarkable combination of characters has been found by the naturalists of the Travailleur expedition off the coast of Morocco, at a depth of 2,300 met. It has a length of .47 met., and a height of 2 cm., the body tapering backwards like that of a macrurid. The cranial part of the head is short (3 cm. long); but the suspensorium and jaws are excessively elongated, the jaws being 9.5 cm. long. The mouth is consequently enormous. A long, slender style constitutes the upper jaw, and is supposed to represent the intermaxillary alone, or possibly the intermaxillary and maxillary amalgamated. The branchial apertures are represented on each side by "a very small orifice forming a simple, rounded, cutaneous perforation situated towards the level of the termination of the bucco-pharyngeal funnel." No fins are described. But the strangest features are revealed by dissection. The respiratory apparatus presents, it is truly said, a constitution which is at present unique in osseous fishes. We find six pairs of interior branchial clefts, and consequently *five branchiae*, each of which is provided *with a double series of free lamellae.* No hyoidean apparatus is developed. (Perhaps the hyoidean apparatus is represented by the anterior pair of branchial arches.) It is also asserted that there are no opercular pieces. Further, the suspensorium is said to be "composed of only two pieces, — a basal piece, the analogue of the temporal; and an external piece, no doubt representing a tympano-jugal." No pneumatocele was found. The form thus characterized has been named by Vaillant Eurypharynx pelicanoides, and is considered as the type of a new family (the Eurypharyngidae). Not only, indeed, does it represent a new family: its affinities are by no means

obvious. By Vaillant it is thought "that the fish presents relations with the Anacanthini, with certain Physostomi (such as the Scopelidae and Stomiatidae), and also with the Apodes." It has, in fact, features of resemblance with the forms noted, as well as with the Saccopharyngidae, but they are wholly superficial. Assuming, of course, the correctness of the characters attributed to Eurypharynx, we are compelled to regard it as the representative of a primitive type of fishes, and perhaps of a peculiar order related to the dipnoan and ganoid series. The examination of the brain, heart, viscera, and skeleton, especially the skull and scapular apparatus, will doubtless definitely determine its relationships. — (*Comptes rendus*, Dec. 11, 1882; *Ann. mag. nat. hist.* (5), xi. 67.) T. G. [520

Reptiles.

Development of the caudal region in lizards. — H. Strahl publishes a renewed investigation of the development of the neurenteric canal, allantois, and tail, in lizards. His researches were made on Lacerta agilis. The early embryonic disk consists of an anterior field in which the medullary groove is subsequently developed, and a posterior field containing the mass of cells forming the primitive streak. From the ectoderm of the front part of the streak is formed an invagination, which deepens and descends obliquely forwards. For some time the cells lining the invagination do not present a distinctly epithelial character, which leads Strahl to consider this lining mesodermic. The lower wall of the canal, thus formed, breaks through, establishing a connection with the entodermic cavity. The axial row of cells in the dorsal wall of the canal becomes elongated, making a thickened epithelial band, which is the *anlage* of the notochord. This *anlage* gradually extends itself farther forward. The neurenteric canal marks the hind limit of the medullary canal and of the chorda, and moves backward during further growth. It is entirely surrounded by mesoderm of the primitive streak. After the complete closure of the neural tube the neurenteric canal closes also. The primitive streak is directly concerned in the formation of the tail and of the allantois. The latter first appears as a solid mass of cells, which afterwards grows out into the pleuro-peritoneal space, and becomes hollowed. The chorda becomes separated from, and overgrown by, the entoderm, in the same manner as has been previously observed in other vertebrates. The caudal gut (*schwanzdarm*) lasts relatively long. Its communication with the intestine is aborted, but the connection with the neurenteric canal continues longer. Strahl argues against Küpffer's view that the neurenteric canal is directly concerned in the formation of the allantois. He also believes the homology drawn by Balfour between the primitive streak and neurenteric canal on the one hand, and the blastopore of fishes and amphibia on the other, to be erroneous. (His arguments on the latter point seem very defective, nor does he appear to thoroughly grasp the problem.) — (*Arch. anat. physiol.; anat. abth.*, 1882, 242.) C. S. M. [521

Permian reptiles. — Professor E. D. Cope exhibited additional remains of Permian reptiles belonging to the genera Diadectes, Empedias, and Helodectes. The scapular arch of Empedias molaris resembles that of the carnivorous type in having a very small coracoid bone. The episternum is very robust, and, ceasing at the anterior part of the arch, does not separate the clavicles below. The claws approach the ungulate type, and are admirably fitted for digging and shovelling. The vertebrae possess the hyposphen first observed in the Jurassic reptilia. In the Permian diggers this process formed a strong articulation between the vertebrae for the purpose of resisting shock; while, in the swimming Jurassic forms, it served to counterbalance the necessary lightness of the bones. The presence of such a structure in these two very distinct forms of life furnishes an interesting example of the employment of the same means to provide for varying necessities. The basioccipital presents the usual reptilian articulations, and was lost from the specimens before described, which were supposed to have four articulating facets. — (*Acad. nat. sc. Philad.; meeting* March 13.) [522

Mammals.

Tongue of Perameles; origin of taste-bulbs. — The tongue of Perameles nasuta, a rare marsupial, contains numerous and remarkable sensory organs, which have been investigated by Edward B. Poulton. Towards the base of the tongue are three circumvallate papillae; the taste-bulbs, numbering 700 or more, lying in the papillary wall of the valla. In the papillae and around them are numerous serous glands. The axis of each papilla is formed by large ganglion, which contains only a few but very large cells, and gives off non-medullated fibres to the taste-bulbs. This is an important observation, since in the organs of sight and hearing there always intervene ganglion cells between the sensory apparatus and the central nervous system. May it not be also the case with all the gustatory organs? The taste-bulbs are comparatively simple, and appear to contain only one kind of cell. The fungiform papillae are chiefly arranged on each side in a single, irregular line; they very rarely contain taste-cells; but occasionally a few are found, which may lie close together, but are not united into a distinct taste-bulb. His observations have led Poulton to formulate the following theory of the origin of taste bulbs: the terminal organs in the mouth would be placed like similar organs in the skin; namely, in papillary ingrowths of the *mucosa;* hence the cells would lie together, and, in assuming the columnar form, they would converge towards the outer surface of the skin. The convergence of the cells would soon lead to their union into a bulb. One more step: differentiation of the central and peripheral columnar cells of the bulb would produce the gustatory organ of the higher mammalia. "This account of the origin of taste-bulbs explains one important difference between them and the other structurally related end-organs, as those of the olfactory region, or sacculi and ampullae; i.e., in the fact that the gustatory cells are massed together in little groups surrounded by protective cells, while the auditory cells in the positions above mentioned, and the olfactory cells, are isolated, each being separately protected by columnar cells. This difference, it appears, is simply due to the latter elongating from a tolerably plane surface, while the gustatory cells have elongated from the curved surface of an interpapillary process, . . . and therefore have met and penetrated the surface in a group."

At the sides of the tongue are long filiform papillae with an axial non-medullated nerve; and over the upper surface are very numerous peculiar papillae, of small size, and surrounded on the summit by a ring of fine, hair-like papillae, generally ten in number; but towards the back of the tongue the hairs disappear on the anterior side, and at last, on the papillae farthest back, there are only two hairs left. The top of the main papilla is concave. The author describes the interesting histology of these organs; but for further details we must refer to the valuable original. — (*Quart. journ. microsc. sc.*, xxiii. 69). C. S. M. [523

The arrangement of the turbinal bones in the fissiped carnivores. — E. D. Cope divides this group of mammals into two tribes, according to the arrangement of the turbinals. The Hypomycteri, including the families Cercoleptidae, Procyonidae, Mustelidae, Aeluridae, Ursidae, and Canidae, have the external nostril occupied by the complex maxilloturbinal bone. The Epimycteri, comprising the remaining families, have the external nostril occupied by the inferior ethmoturbinal and the reduced maxilloturbinal. — (*Proc. Amer. philos. soc.*, xx. 1882, 471.) F. W. T. [524

ANTHROPOLOGY.

The prehistoric antiquity of man. — In his recent work (reviewed in this issue) Mortillet says, "Palaeoethnology is the study of the origin and development of humanity, before the occurrence of historic documents. This science is divided into three parts: 1°. The study of tertiary man, or the origin of humanity; 2°. The study of quaternary man, or the development of humanity; 3°. The study of man in the present epoch, the prolegomena or first horizon of history." The following scheme, of which the work is an elaborate development, will convey some idea of the patience and originality of the author, whatever may be our opinion concerning the durability of his work.

Temps.			Âges.	Périodes.	Epoques.
Actuels.		Historiques.	Fer.	Mérovingienne.	Wabenienne, Franque, Burgonde, Germanique.
				Romaine.	Champdolienne. Decadence Romaine.
					Lugdunienne. Beau-temps Romain.
		Protohistoriques.		Galatienne, Etrusque.	Marnienne, Gauloise. 3e Lacustre.
					Hallstattienne, des tumulus. 1re du fer.
		Préhistoriques.	Bronze.	Bohémienne.	Larnaudienne, du marteleur. 2e Lacustre en majeure partie.
					Morgienne, du fondeur. 2e Lacustre partie.
			Pierre.	Néolithique, Pierre polie.	Robenhausienne. 1re Lacustre, des dolmens.
Géologie.	Quaternaire.			Paléolithique, Pierre taillée.	Magdalénienne, des Cavernes, en majeure partie, du Renne presque totalité.
					Solutréenne, du renne partie, du mammouths partie.
					Moustérienne, du grand ours des cavernes.
					Chelléenne, Acheuléenne, du mammouths partie, de l'Eléphas antiques.
	Tertiaire.			Eolithique, Pierre étonnée par le feu.	Thenaisienne.

On pp. 28 and 29, the eolithic period is tabulated into upper secondary, eocene, miocene, and pliocene, and further subdivided into thirteen epochs. Part I. (chapters i.–xv., p. 25–125) relates to tertiary man; part II. (chapters i.–xxiii., p. 127–476), to quaternary man; and part III. (chapters i.–xii., p. 479–627), to recent man. One feature of the book will be viewed with favor, that is, the addition of the author's name, in parentheses, to significant discoveries; as, Deposits containing gashed bones of Balaenotus (Capellini), Calaveras skull (Whitney), Delaware gravels (Abbott), etc. — J. W. P. [525

The cerebral convolutions of man. — In 1839 Leuret ascertained that the number and the disposition of the primary convolutions of the brain were constant in different species of mammals. Arrested by disease, on his way to the tomb he confided his work to Gratiolet, who, actuated by the comparative method, extended his researches to the entire series of primates, and succeeded in bringing order out of the chaos of convolutions in the human brain. The labors of these two brilliant investigators were followed up by many as talented as they, — such as Arnold, Bischoff, Ecker, Flower, Huschke, Huxley, Marshall, Meynert, Pansh, Rolando, Rolleston, Turner, Vogt, and Wagner, — but by none with more zeal and care than by Paul Broca of Paris. Even from his tomb he reaches forth his hand to cast one more ray of light upon this obscure subject; for we find, in the January number of the *Revue d'anthropologie*, a paper entitled "Elementary descriptions of the cerebral convolutions of man explained by the brain-chart." Broca was nothing if he was not laborious and painstaking. He had hundreds of brains cast. He examined them all to ascertain the forms that were typical. By means of painted casts and charts he taught his pupils the geography of the brain, as one might teach children the map of Europe. He introduced a system of nomenclature for the hemispheres, the fissures, furrows, lobes, convolutions, and branches, so that the student could follow up his work with a description as accurate as that of the anatomist dissecting a bird. Indeed, this paper is a text-book upon human cranio-cerebral topography. — (*Rev. d'anthrop.*, Jan., 1883.) J. W. P. [526

The skulls of criminals. — Drs. Corré and Roussel have communicated to the French anthropological society the results of their researches upon 202 criminals whose crania are preserved in the museum of anatomy at Brest. They have arrived at the following conclusions: —

1. The skull is remarkable in criminals for a horizontal development, generally above the mean.
2. The sub-brachycephalic, brachycephalic, and mesaticephalic types are much more numerous than the dolichocephalic.
3. The proportion of asymmetry is enormous. It varies little in the different categories, and in the whole criminality it amounts to 65.3 to the 100. It is at its maximum (7.05) among those condemned for immorality and rape; at its minimum (60), among those condemned for attempts upon life.
4. The deformations of the transverse vertical curve are very remarkable among thieves. Among them, as well as on those condemned for attempted violations of virtue, are to be found a certain number of carinated crania.
5. The deformations of the antero-posterior median curve are common in all the groups: they arise mostly from the flattening of the bregma and of the posterior parietal region.
6. These results confirm and complete those already obtained by several investigators (Broca, Bordier, etc.). — (*Revue d'anthrop.*, Jan. 15, 1883.) O. T. M. [527

EARLY INSTITUTIONS.

Our early economic history.—Professor Meitzen of Berlin reviews von Stein's '*Drei fragen des grundbesitzes*,' and takes occasion to say a great deal that is interesting upon the land-question and the past history of land-holding. One or two points may be noted here. Had we space, we should note other points. The article is significant in many ways. Von Stein makes collective possession and ownership of land the starting-point of our economic development; but Prof. Meitzen says, what is certainly true, that, so far back as the time of Tacitus, private property in land existed everywhere. This property consisted regularly of hides, what the Germans call *hufen*. Attached to these hides were shares or rights in the undivided land,—the *almend*. The hides were divisible in the early time. It was during the feudal period that they came to be indivisible. Without doubt the land was common, open to everybody, during the period of migrations,—the nomad period; but this condition of things did not last long. The land in one place supports only a limited number of animals. A large number cannot graze together. Separate districts were accordingly assigned to separate herds, or several small herds together. These herds would belong to different families. While some of these families grew rich and powerful, others grew poor and weak. The latter were driven from their lands, or reduced to dependence and servitude. Then, as there were dependents and slaves to do the work, agriculture arose. Hides were assigned to the cultivators, which were the property of their respective lords. It is probable that the undivided common land was at this time subject to appropriation. Every man could have, therefore, as many hides as he wanted. It was at a later time, probably, that the common land became subject to communal regulations. This is Prof. Meitzen's theory, as we understand it. It is certainly a great advance on the old theory of primitive equality and communism. Prof. Meitzen says, "Es ist also allgemeine gleichheit der alten Germanen eben so fabel wie allgemeine freiheit." — (*Jahrb. nationalökon. stat.*, Jan. 13.) D. W. R. [528

Land-holding in Damaraland.—C. G. Büttner describes how the land is free to everybody; how the individual appropriates as much of it as he pleases, wherever he pleases, provided he does not, in so doing, trespass upon land already appropriated. There are no boundaries between one man's land and another's; only it is generally considered wrong to enter upon land that has been brought under cultivation by another. The chief wealth of the people consists of flocks and herds, which are driven about from place to place by the owners or the herdsmen. Family life is patriarchal. Slavery exists in a mild form. "Whatever a man puts his hands upon, that is his private property." The writer, or his translator, calls this communism!—(*Pop. sc. monthl.*, March, 1883. From *Ausland.*) D. W. R. [529

Slavery in Europe.—M. Fournier gives us a long article upon the liberation of the slaves in western Europe between the fifth and thirteenth centuries. He considers the parts taken by the church and state respectively in this movement, and concludes that the church was far less instrumental in bringing about the abolition of slavery than has been generally supposed. — (*Rev. hist.*, Jan.-Fév., 1883.) D. W. R. [530

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

New-York agricultural experiment station, Geneva, N.Y.

Variability of maize. — Were the different forms of ear-corn, raised from seed of uniform appearance, shown to one not acquainted with the variability of maize under hybridization, the collection would be referred to many varieties, and perhaps to several species. Even to one who has made a study of the subject, there is a constant series of surprises. As a slight contribution to the subject of the hybridization of corn, I note the following forms as gathered from a small plat planted with fine, uniform-appearing seed of 'podded' corn from an unknown source.

This podded corn is that curious variety wherein each kernel, as well as the whole spike, is surrounded by a husk. It is known under various names; such as, husk corn, Paraguay corn, Texas corn, wild corn, Oregon corn, etc. The variety planted showed a yellow, dent, elongated kernel, each kernel husked, and of a uniformity which suggested an extreme purity or fixity of type.

The crop harvested yielded: 1°. Tassel-corn,—some of the kernels heavily, others slightly husked, and others bearing, in all but size, a most striking resemblance to sorghum-seed, both in shape and structure, and the husk changed to a glume; 2°. Ears with kernels uniformly and lightly husked; 3°. Ears in which the kernel-husk has increased in abundance and length on successive ears, until at last the husk predominates over kernels; 4°. Ears of husked grain, the rows arranged in pairs, the apex of the husk of each of the rows of each pair facing inward; 5°. Some husked ears, but the kernel-husks pure white in some specimens, tinged with red in others; 6°. Fastigiate ears, i.e., a whole mass of ears, each ear occupying the position of a kernel on the cob, and arranged parallel to each other; 7°. Unhusked corn,—red cob, yellowish-white dent kernel, with a sprinkling of sweet-corn kernels through cross-fertilization; 8°. A dark purplish-red ear of unhusked corn,—a dent corn, mingled with some dark-red kernels of sweet-corn.

Variations equally surprising have occurred with us from a fine-appearing white 'pearl' pop-corn used as seed. From the crop, we selected nine ears, any one of which might well be referred to a distinct variety. Some of the ears formed 'rice-corn,' or the kernels mucronate; other ears had the smooth, round, stony grain of the pearl varieties; other ears had taken on the appearance and size of a field flint-corn. The colors varied from white, through the buffs, to yellow, and from light red to dark red, forming, in the nine specimens, nine different colors or shades. The number of rows also differed, and the size and shape of ear.

In habits of growth, some varieties of corn bear the ears on the nodes quite low down, others on the higher nodes; but no variety, so far as numerous observations extend, bears ears on the five upper nodes of the plant. Yet in individual variations a perfectly husked ear is borne on the first node from the tassel; and even four well-husked ears have been found borne grouped around this first node.

While, normally, ears are produced from the axil of

the leaf (i.e., are axillary branches), yet in individual variations a branch may occur in this situation, and one or more ears be borne upon this branch, one ear being terminal.

The tassel may be transformed into groups of ears, the whole character of the tassel being occasionally changed to such an extent that the pistillate flowers replace the staminate. The bearing of a few grains upon the tassel is by no means an unfrequent occurrence. In the case of the tassel bearing many grains, there is a tendency in the upper leaf to curve upward and form a husk, and in cases a fair protection is thus secured.

On the other hand, the terminal portion of the normally situated ear may be extended so as to form a tassel which bears staminate flowers. In rare cases we have a normal appearance of ear for several inches, then a few inches of staminate flowers, and at the end a good ear again; the two perfectly formed ears being connected as if by a section of a tassel-stem, and forming a structure protected by a common husk. Staminate flowers are also occasionally produced on the rachis, along with the normal pistillate flowers; and I have even observed hermaphrodite flowers, — in one case on the cob, and in two cases on the tassel. In cases, also, the ears are branched; the branches starting from the base, or from the middle or terminal portion of the ear. In the tassel we quite frequently find ears crowded together through partial coalescing of the branches, so as to form a corolla, or cup, from which the main stem of the tassel emerges; and, in their normal situation, ears are occasionally so crowded, through branching, as to form a sort of bouquet. The tip of the ear may also divide into many smaller portions, forming the appearance of a tassel-like bunch of cobs terminating the grain-covered portion.

The rows of corn are always even-numbered, but may vary from 8 to 32 in varieties, and, in individual specimens, from 4 to 48. In two ears from the same stalk the number of rows may vary; the length of ear, from 2 to 12 inches in varieties, and in individual variations perfect ears may be found from 1 to 16 inches in length. The kernels are occasionally arranged upon the cob in a spiral. The size of the grain is also subject to great variation. In our collection, normal kernels of a variety called 'miniature' maize weighed one-half a grain, while normal kernels of a variety known as 'Benton dent' weighed 12 grains.

The shape of the grain is very varied. It may be longer than broad, or broader than long, varying from oval to shoe-peg form in flat and spherical variations; the upper surface rounded, or flattened, or pointed, or dented. The dent may be a central depression, as a notch, or a crease, or irregular. A cross-section is in some varieties square, in others rectangular, in others round, in others oval, in still others irregular. The structure may be all farinaceous, as in the Tuscarora; or semi-transparent and hardened, as in sweet-corns; or hard and horny, as in the pop-corns; or partly farinaceous and partly corneous, as in the common flints and dents. The chit also varies in length in the varieties, and in the form of the depression in which it lies; and the pedicle of the grain may appear strongly marked, as in the 'pod-corn.'

In germination, occasionally twin-embryos are formed, and in one case we have noted three. The roots may emerge from the base of, or may crowd off, the caulicle, and appear from the under side, or, in cases, may emerge from the caulicle at apparently any point. From the first node they almost invariably emerge. We thus seem to have a double system of roots, — the tap-root, emerging from the base; and the fibrous roots, which emerge from the sides of the caulicle. In exceptional cases the tap-root seems suppressed and the fibrous roots of the monocotyledon appear in its stead.

After the corn-kernel has germinated, it may be thoroughly dried, and will then start anew when planted. The plumule retains its life while new roots are formed, or exceptionally the descending axis retains its life, and renews its growth. This we have repeated to the fifth germination, with intervals of one week's drying between germinations. In one instance of variation a twin-embryo sent up two cotyledons, one of which afterwards developed into a leaf. This was the only case among many hundreds of observations. E. LEWIS STURTEVANT, *Director*.

March 13, 1883.

University of Cincinnati.

Laboratory notes. — Several investigations, conducted under the direction of Prof. F. W. Clarke, are far enough along to warrant preliminary notices.

The phosphides of platinum have been prepared by O. T. Joslin. When phosphorus is thrown upon white-hot platinum, fusion takes place, and a brittle, silver-white button of Pt_3P_5 is obtained. This, treated with hot aqua regia for at least forty hours, only partly dissolves. The soluble portion agrees sharply with the formula Pt_2P_4, and PtP remains absolutely insoluble. By long roasting in a muffle, the original Pt_3P_5 is reduced to Pt_2P. The Pt_2P_4 is probably identical with the phosphide described by Schrötter as PtP_2.

The tartrates of antimony are being studied by Mr. C. S. Evans, and one set of results is complete. When alcohol is added to a solution of Sb_2O_3 in aqueous tartaric acid, a white precipitate is formed, concerning which earlier experimenters differ. We now find, that at least three distinct compounds may be thus produced, as follows: when there is a large excess of tartaric acid, the neutral salt $Sb_2(C_4H_4O_6)_3 . 6H_2O$ is thrown down. With a slight excess of acid, $Sb_2(C_4H_4O_6)_2O . 6H_2O$ is produced. The third compound should be $Sb_2(C_4H_4O_6)O_2$, and is said to have been described by Berzelius. We have obtained a compound approximating to this formula, but it was not absolutely pure. All three salts may be regarded as derived from Sb_2O_3 by successive replacements of one, two, and three atoms of oxygen by $C_4H_4O_6$.

The specific gravity of cadmium iodide is given, on Bödeker's authority, as 4.576. Mr. E. A. Kebler, assisted by Mr. E. Twitchell, has prepared the compound in a variety of ways; and we find that two distinct modifications exist. The normal CdI_2 has a specific gravity of 5.6 to 5.7, and is very stable: the other ranges from 4.6 to 4.7, is deliquescent, and decidedly unstable. The conditions governing the formation of the latter have yet to be made out. The normal salt represents union of cadmium and iodine without change of volume.

NOTES AND NEWS.

— The lecture season at the Lowell institute in Boston is drawing to a close. So far back as most of us can remember, the institute has annually tempted some distinguished scientific Englishman or other European to lecture to Boston audiences, and has done, perhaps, as much as any other establishment in the country to elevate the scientific standard. This year an unusual variety has been offered, and the au-

diences have been large and attentive. The courses were opened toward the end of October with six lectures by Dr. William B. Carpenter of London, on the Physical geography of the deep sea, in which he treated successively of the oceanic basin generally, thermal significance of oceanic water, action of prevalent winds on the ocean-surface producing horizontal circulation, physical conditions of inland seas, animal life of the deep sea, and land and sea in geological time. This was followed by a second course of six lectures by the same on Human automatism. The question was stated in the first lecture, and was followed by a discussion of congenital or primary automatism, secondary or acquired automatism, automatism in intellectual action, of the motive powers, and in morals.

On alternate evenings during the progress of these courses, Dr. George L. Goodale of Harvard university gave twelve lectures on Physiological and geographical botany; an outline sketch of some of the relations of plants to their surroundings. These series were followed by a course of six lectures on Motion and matter, by Professor Thomas C. Mendenhall of the Ohio state university, beginning Dec. 4; by twelve lectures on the Philippine Islands, with sketches of Panama, Japan, China, Singapore, Ceylon, the Red Sea, and the Mediterranean volcanoes, by Dr. Samuel Kneeland of New York, on Dec. 12 and following days. Three lectures on Storms were given by Mr. W. M. Davis of Harvard university, beginning Jan. 8; two on the Jelly-fishes, by Dr. J. Walter Fewkes of the Museum of comparative zoölogy, on Jan. 22 and 25. On Jan. 23, Professor Samuel P. Langley of the Allegheny observatory began a series of twelve lectures on the Sun and stars. Professor James T. Bixby of the Meadville theological school is about finishing a course of twelve lectures on the Inductive philosophy of religion; and Mr. F. W. Putnam of the Peabody museum began, March 13, his current course of six lectures — the last, we believe, for the season — on American archeology. The topics of the several lectures in this last course are, 1°. Ancient mounds, earthworks, and fortifications in the United States; 2°. Explorations of ancient towns; 3°. Stone graves of the Cumberland valley, and their contents; 4°. Ancient pottery; 5°. Altar-mounds and their contents; 6°. Burial customs, and the arts of the ancient Peruvians.

— The meeting of the International commission on the geological map of Europe was held at Foix last September. The commission consists of two committees, — one on the map, and one on nomenclature. The former is composed of Messrs. Beyrich and Hanchecorne (directors having but one vote), Daubrée, Giordano, De Moeller, Mojsisovics, and Topley. At the last meeting, Messrs. Daubrée, Mojsisovics, and Topley were absent. The Austrian and German geologists have agreed to form only one commission for the execution of the geological work of central Europe. A scale of the sedimentary formations, adopted by Austrian and German geologists, was accepted as a provisional basis for discussion. The commission voted unanimously to adopt the proposition of Mr. Neumayer to appoint a committee to compile a paleontological nomenclator. Much difficulty, however, seems to have arisen in coming to a general understanding about this nomenclature. The length of time required for the publication of the map will probably exceed the limit of six years. Some of the geographical sheets are already engraved, and a number of others are drawn. Assent to the subscriptions demanded had not yet been received from France, Spain, Scandinavia, Germany, and Denmark. The last meeting of the commission previous to the Berlin congress of 1884 will be held at Zurich, probably in August. The general price of the map will be 125 francs to the public, 100 francs to the subscribing governments.

— The Smithsonian institution, in co-operation with the Biological society of Washington, is making an effort to procure full statistics with regard to the trees, shrubs, and herbaceous plants growing in the public grounds of the city and suburbs. In order to trace the changes which have taken place in tree-planting in this district, it is desirable to learn what kinds were grown here soon after the permanent establishment of the government in Washington in 1800, and where specimens of these can now be examined. Information is wished for as to any rare or remarkable trees known to have stood in the public grounds, but removed during the extension of public buildings or other improvements, or of trees of great size or age, or remarkable for their connection with public events.

— Dr. J. C. Houzeau, director of the Royal observatory at Brussels, has returned to Belgium from his expedition to the United States to observe the transit of Venus, and, having obtained leave from his government, will spend the remainder of the winter season at Cannes. The king of Belgium is anxious to have the observatory transferred to Lacken, to an eligible site in the vicinity of his castle; but as yet the removal is not definitely decided upon. A temporary shed has been erected for the new meridian-circle made by the Repsolds.

— According to *Nature*, March 8, the mathematical papers and memoirs of the late Professor Henry J. S. Smith of Oxford are to be collected and published in two quarto volumes by the press of his own university. Miss Smith will contribute a biological introduction; and the general editorship of the work, which will include a considerable quantity of hitherto unpublished material, will be intrusted to Mr. J. W. L. Glaisher.

— Eugene G. Blackford issues a most attractive invitation to witness the 'display' of brook-trout he will make at his stalls in Fulton Market, New York,

April 2, at the 'opening of the trout-season, 1883,' when "examples of fish-culture from all the leading fish-culturists and fish-commissioners of the United States will be displayed." The folded card of invitation is printed in colors by Armstrong & Co. of Boston, and represents a trout-brook and fishing-paraphernalia on one page, while the opposite reproduces an admirable sketch of swimming trout by Beard. The whole is done in admirable taste.

— The fifth annual meeting of the Sanitary council of the Mississippi valley will be held at Jackson, Miss., April 3. Dr. John H. Rauch, secretary of the Illinois state board of health, is secretary of the executive committee.

— The finished portion of the new chemical laboratory for Phillips academy, Andover, Mass., was first occupied by the class in analytical chemistry March 5. For want of funds, only the east wing has as yet been built. The estimated cost of the whole is $20,000.

— A despatch from London, dated March 21, states that an eruption of Etna has occurred, accompanied by an earthquake, overthrowing several houses, and causing a panic in the vicinity. A despatch from Catania, two days later, reports eleven fissures in the mountain, and the central opening as active, but adds that there is no discharge of lava. Rome telegrams of the 25th, however, state that the eruption is unimportant and apparently subsiding.

— We are glad to aid in calling attention to the Association for the preservation of the scenery of Niagara Falls, formed in New York with the support of Messrs. G. W. Curtis, H. Potter, Ch. Lanier, J. H. Robb, and many others, for the purpose of securing state assistance in rescuing the neighborhood of the falls from unsightly surroundings. Through the efforts of this association, a bill has just passed the New-York Assembly, authorizing the appointment of commissioners to survey the lands about Niagara, and report to the next legislature. The bill has still to pass the senate, and receive the governor's approval. Membership in the association may be obtained by a subscription of ten dollars; and smaller contributions will be acceptable, as a considerable expense is incurred in keeping the matter before the public. The secretary is Rev. J. B. Harrison, P.O. box 105, New York; treasurer, Ch. Lanier, Esq., corner Nassau and Cedar Streets, New York. Dr. V. Y. Bowditch, 113 Boylston Street, Boston, will forward subscriptions from New England.

— The treasurer of the Balfour memorial fund acknowledges the following subscriptions: Joseph Le Conte, University of California, $5; J. G. Scott, principal State normal school, Westfield, Mass., $5; Samuel Garman, Harvard University, $3; Walter Faxon, Harvard University, $5; A. H. Tuttle, State University, Columbus, O., $20; previously acknowledged, $385.

— Two correspondents of the *Scientific American*, March 17, give accounts of curious snowballs formed by the wind blowing over the surface of loose snow. The snow was formed into cylinders, with conical cavities at each end, nearly meeting in the centre, resembling rolls of cotton-batting. The fields are described as covered with rolls from the size of an egg up to twenty inches in diameter and forty in length.

— It is proposed to close the gap at the Delaware Breakwater with a concrete superstructure, resting upon a granite rip-rap foundation. This is necessitated by the deterioration of the harbor from a marked decrease in depth. At the meeting of the Philadelphia engineers' club, Feb. 17, Mr. J. M. Stewart described the plans for the improvement.

— Professor Thomas H. Huxley of London was elected a foreign honorary member of the American academy of arts and sciences at its last meeting, March 14, in place of the late Professor Bischoff; and Dr. Johann F. J. Schmidt of Athens, in the place of the late Professor Plantamour.

— John Burroughs writes charmingly and truthfully of 'Signs and seasons,' in the March *Century*.

— At the meeting of the Appalachian mountain club, March 14, Prof. E. C. Pickering read a paper on mountain observatories, and Mr. A. E. Scott one on the exploration of the Twin Mountain range.

— The forty-third regular meeting of the Biological society of Washington was held March 16. Mr. Orville A. Derby communicated some biological notes from Brazil. Mr. William T. Hornaday spoke on the mental capacity of the elephant, and Mr. Newton P. Scudder on the length of the hatching-period of the domestic fowl. Specimens illustrating giant clams of the Pacific were exhibited by Lieut. Francis Winslow, U.S.N.; accidents to animals, by Mr. F. A. Lucas; sections of hermaphroditic oysters, by Mr. J. A. Ryder; fossil ship-worms, by Dr. C. A. White; and microscopic sections of supposed coal, by Mr. George P. Merrill.

— At the meeting of the Boston society of natural history, March 21, Prof. S. P. Sharples gave an account of a visit to Turk's Island, and Mr. S. Garman made some remarks on fossil horses.

— The Field naturalists' club of Ottawa held their fifth *soirée* on Friday, March 16. Mr. W. P. Lett read a paper on the ducks resorting to the neighboring waters, and gave most interesting and valuable descriptions of their habits and food, — the result of many years' experience as a sportsman and observer of nature. Mounted specimens of the various ducks were exhibited. Dr. Small read the report of the botanical branch of the club on the work of the preceding season. It showed that twenty-five species of plants had been added to the lists already published, and gave many interesting facts concerning the occurrence of these and other rare species. Several exquisite paintings of rare plants were made for the

occasion by Mrs. Chamberlin. Mr. W. H. Harrington read the report of the entomological branch, indicating the work so far accomplished in the study of the Ottawa fauna, and the amount that would still be required to develop a knowledge of the various orders. The report referred to some rare species, and to others which had been unusually abundant or destructive. A case specially prepared showed many of the insects mentioned, with labels giving scientific and common names, and food-plants. Some discussion followed the lecture and reports; and a vote of thanks was tendered to the lecturer for his valuable paper.

—The electrical exhibition at Caen, France, will open May 15. The board in charge consists of Count du Moncel, honorary president; MM. Boreux, Boutard, Lecornu, Rabut, Professor Neyreneuf, M. Berjot, *père*, MM. Baumier and Verlene. Any applications for space should be addressed to the mayor of Caen, who is also a member of the board.

—A paper on Our coal interests, read by P. W. Sheafer at the annual meeting of the Mining institute of Pennsylvania, held at Shenandoah, Jan. 27, has been printed in full in the Mining herald of that place for Feb. 24.

—The *Scientific American supplement* for March 17 contains a long article by L. P. Gratacap, on the American museum of natural history in Central Park, New York.

—The second report on the Peter Redpath museum of McGill university, just issued, contains several papers by Principal Dawson, noticing important donations, and describing new and interesting specimens: one on a whale from the Saxicava gravel, near Smith's Falls, Ontario, 420 feet above the St. Lawrence; another on miscellaneous carboniferous fossils from the eastern provinces; and a third on graptolites of the Quebec group.

—Telegrams to the daily press announce that the scientific expedition sent out by the United-States government, under the charge of Prof. Edward S. Holden, to observe the coming eclipse of the sun at the Caroline Islands, reached Lima, Peru, in good health, and had just sailed thence in the U. S. sloop-of-war Hartford for their destination.

—Dr. Paul Topinard took occasion, at one of his last spring's course of lectures at the school of anthropology in Paris, to sum up the labors of Count George Louis LeClerc Buffon [1707–1788] as a student of the natural history of man, considering him "as the chief of the new school which produced Étienne Geoffroy Saint-Hilaire, and the precursor of Lamarck and Darwin." — "He was not only the precursor of Lamarck, but his inspirer."

—In our Summary, paragraph 372, for 'Rurichnites,' read 'Rusichnites,' and for 'Traena,' 'Fraena.'

RECENT BOOKS AND PAMPHLETS.

Adrews, L. W. I. Zur kenntniss einiger isomeren bromnitrobenzolsulfonsäuren. II. Ueber triphenylborat. Bonn, 1882. 45 p. 8°.

Barner, F. Krystallographische untersuchung einiger organischen verbindungen. Göttingen, 1882. 45 p., pl. 8°.

Bellardi, L. I molluschi dei terreni terziarii del Piemonte e della Liguria. III. Gasteropoda. Torino, *Loescher*, 1883. 253 p., 12 pl. 4°.

Bethke, A. Ueber die bastarde der veilchen-arten: inaug.-diss. Königsberg, *Beyer*, 1882. 20 p. 4°.

Beyda, H. F. T. Mathematische beschäftigungen aus früheren jahren. i., ii. heft. Stuttgart, *Metzler*, 1883. 48 p. 8°.

Boedeker, H. I. Ueber benzylanalin und phenylbenzylhydrazin. II. Diazobenzoleinid und jodaethyl: inaug.-diss. Göttingen, 1882. 36 p. 8°.

Brauer, F. Offenes schreiben als antwort auf Hrn. Baron Osten-Sackens 'critical review' meiner arbeit über die notacanthen. Wien, *Hölder*, 1883. 11 p. 8°.

Caldarera, F. Introduzione allo studio della geometria superiore. Vol. i. Palermo, *Lauriel*, 1882. 626 p., 8 pl. 8°.

Charencey, H. de. Mélanges de philologie et de paléographie américaines. Paris, *Leroux*, 1883. 195 p. 8°.

Clevenger, S. V. Art institute lecture on artistic anatomy and the sciences useful to the artist. Chicago, *Newell, pr.*, 1883. 20 p. 8°.

Corrente, G. Sulla fillossera. Caltanissetta, 1882. 10 p. 4°.

Doormann, C. Anwendung der Lamé'schen functionen auf probleme der potentialtheorie bezüglich der dreiaxigen ellipsoids und der Fresnel'schen elasticitätsfläche: inaug.-diss. Leipzig, 1882. 74 p. 8°.

Ebert, T. Die tertiären ablagerungen der umgegend von Cassel: inaug.-diss. Göttingen, 1882. 28 p. 8°.

Garbini, A. Apparecchio della digestione nel Palaemontes varians. Verona, *tip. Franchini*, 1882. 89 p., 3 pl. 8°.

Kraetzschmar, L. Ueber die verbreitung der lecithin im pflanzenreich: inaug.-diss. Göttingen, 1882. 30 p. 8°.

Landsberg, Max. Ueber imide zweibasischer säuren: inaug.-diss. Königsberg, *Beyer*, 1882. 58 p. 8°.

Loe, A. Ueber den glycerinäther: inaug.-diss. Göttingen, 1882. 37 p. 8°.

Luerssen, Chr. Die pflanzen der Pharmacopoea germanica botanisch erläutert. i lief. Leipzig, *Haessel*, 1883. 64 p., illustr. 8°. [To contain 6–7 lief.]

Manzoni, A. La struttura microscopica delle spugne silicee del miocene medio delle provincie di Bologna e Modena. Bologna, *Treves*, 1882. 24 p., 7 pl. 4°.

Mari, G. La storia naturale nelle sue applicazione, con riguardo speciale ai prodotti italiani. Milano, *Rivolta*, 1883. 11+904 p. 8°.

Matthews, F. E. I. Verbindungen der blausäure mit den halogenwasserstoffsäuren. II. Condensation einiger aldehyde mit acetessigäther, etc.: inaug.-diss. Bonn, 1882. 42 p. 8°.

Merrick, C. S. Ueber die einwirkung von jodallyl auf anhydrobenzolyldiamidobenzol: inaug.-diss. Göttingen, 1882. 34 p. 8°.

New York—State survey. Report for the year 1881. James T. Gardiner, director. Albany, *Weed, Parsons, & Co., pr.*, 1882. 81 p., 1 pl. 8°. 5 maps.

Olleck, H. von. Analytische untersuchungen über das verhalten von phosphaten zu citronensäure-lösungen: inaug.-diss. Göttingen, 1882. 29 p. 8°.

Oschatz, F. Experimentalle untersuchungen über die physiologische wirkung der chinolins: inaug.-diss. Göttingen, 1882. 50 p. 8°.

Pieper, R. Ueber einige metamere hydroxylaminderivate: inaug.-diss. Königsberg, *Beyer*, 1882. 38 p. 8°.

Schirmacher, E. Die diluvialen wirbelthierreste der provinzen Ost.- und Westpreussen: inaug.-diss. Königsberg, *Bayer*, 1882. 52. p., 5 pl. 8°.

Schutzkwer, Nachum. Das coffein und seine verhaltung im thierkörper: inaug.-diss. Königsberg, *Bayer*, 1882. 25 p. 8°.

Steffen, M. Die landwirthschaft bei den altamerikanischen kulturvölkern. Leipzig, 1883. 139 p. 8°.

Wandtafeln (Vier) zur erklärung der elektrodynamischen maschinen. München, *Buchholz*, 1883. imp. f°. Mit text, 10 p. 8°.

Wiesinger, F. Ueber die einwirkung von eisenchlorid auf orthophenylendiamin: inaug.-diss. Göttingen, 1882. 31 p. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge o[illegible] [illegible]onday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single [illegible] [illegible]es, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "ED[illegible] [illegible] OF SCIENCE, *Cambridge, Mass.;*" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press. Rand, Avery, & Company, Boston.

FRIDAY, APRIL 6, 1883.

DISTRIBUTION OF PUBLIC DOCUMENTS.

The report regarding the publication and distribution of public documents, prepared by a special committee of experts, Messrs. Ames, Spofford, and Baird, and recently issued from the Government printing-office, is the fruit of one of those spasms of virtue that is apt to overtake spendthrifts, individual or corporate, at the end of a period of peculiarly unreasonable waste and folly. In any well-managed government, the conditions which this report shows to exist would be a matter for chagrin and for immediate remedy; but, as the remediable waste probably does not exceed a million of dollars at the most, it will be perhaps too trifling an evil for attention.

The committee report that they "are very deeply impressed with the number of documents printed by authority of Congress, aggregating, for the forty-sixth Congress, 2,324,254, and, for the first session of the forty-seventh Congress, 1,354,947. . . . They are no less deeply impressed with the lack of system and economy in the distribution of these documents. . . . Under the practice now prevailing, nearly all documents, whatever may be their cost and value, are distributed by from two to four agencies, each in ignorance of what the others are doing."

They recommend a single agency for all the distribution, that the public libraries have the first care, and that discretion be shown in the choice of libraries which are to receive the full sets of congressional documents. They print twenty-four pages of tables, giving, in fine type, a list of the 'documents' printed by the forty-sixth Congress, — a wonderful list, in which the transit of Venus comes against the Fitz John Porter case, and the eulogies on Z. Chandler succeed the nautical almanac. Congress assumed that twelve thousand persons needed to hear what Congress said on the death of the above-named statesman, while only half that number needed information on the chinch-bug; three thousand required information on the flags of maritime nations, while only twelve hundred wanted the third volume of the geological survey.

The number of scientific books is surprising. There are about fifty volumes upon such topics, not including reports that are partly scientific, nor the census publications, many of which should be placed in this category.

One of the results of this deluge of free scientific books is, that any private publication of works of this nature is well nigh impossible in this country. Our people have been brought to the state of mind where they assume that any large, well-printed, elaborately illustrated work was, of course, made to be given away.

There are good reasons for the publication of most of the public scientific works. Many of them are an honor to the government, and of great value to science; but the system of distribution has been to the last degree absurd, and not a little damaging to the best interests of scientific men. The publication of this document, and the recent action of Congress, are steps towards the reform of the evil. If the government will heed the sagacious recommendations of their committee, the worst of these evils will be cured.

THE VARIATION OF TEMPERATURE UNDER CONDITIONS PRESUMABLY THE SAME.

In all comparisons of standards of length, the accurate ascertainment of the temperature is a matter of the utmost importance. A neglect of proper precautions in regard to this point will frequently, if not generally, introduce greater uncertainty into the results than all other sources of error combined. The importance of knowing the temperature will be readily admitted by all, but the difficulty of ascertaining it is by no means fully appreciated. The writer has himself seen costly and elaborate comparators which were used in the open air of a room without any provision for protecting the bars under comparison from the influence of heat radiated from the observer's body. He has also read letters of persons whose ideas of accuracy were far beyond their ability to achieve, and who wished for the standards they would send for comparison a refinement of determination that would be instantly lost in the uncertainty of the temperature under the conditions to which they

would be subjected in use. It is this difficulty of accurately knowing the temperature, that has demanded the expenditure of so much time, talent, and money, in the construction of compensating bars for base measurement. Were it possible for a thermometer to accurately register the temperature of a metallic bar beside which it was laid, a simple rod or bar would form the most accurate base-measuring apparatus, as there would be no risk of any parts getting out of order.

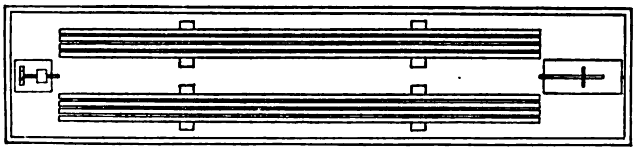


FIG. 1.

In the comparisons upon which he has been engaged in the Bureau of U. S. standard weights and measures, the writer has had frequent occasion to notice the variations of temperature under conditions which would ordinarily be presumed to be the same; and he has had forcible evidence of the fact, that no matter how well the conditions are controlled, or how carefully the bars may be protected, we can never rely upon two bars having the same temperature. No doubt they often have the same temperature; or, when a difference exists, its effect is inappreciable. Still, there is an uncertainty in the matter which can be eliminated only by a careful interchange of relative positions.

A marked illustration of what is said above is given in the following case. The comparisons were made by the writer. The circumstances of comparison were as follows: seven steel end-metres were to be compared with a standard metre. The comparisons were made in a room about 20×16 feet in size. This room was at the north-east corner of the building, so that two of its sides were outer walls. They were about two feet thick. The room was below the level of the street in front, but had free circulation of air around the outer sides, the building being separated from the coal-vaults in front by an area five or six feet wide. The comparator was parallel to the eastern (longer) side of the room, and about three feet from it. The doors of the room were kept closed, and the daily range of the temperature seldom exceeded three degrees. Two windows in the eastern wall were closed with a double glass sash and a solid wooden frame; and, to more effectually close them against passage of air, heavy manila paper was closely pasted over the entire frames. The eight bars were supported on racks, in two groups of four each, on both sides of the position that a bar would have when lying between the abutting-screw and contact-slide of the comparator. As the bars lay in the rack, they were about three-quarters of an inch apart from centre to centre. The extreme bars were about seven inches apart. The arrangement is shown in Fig. 1.

The bed-plate of the comparator was a framework of solid wood several inches thick. The bars and comparator were covered by a framework of wood and heavy plate-glass. The manipulation of the bars was effected by long pliers working through two narrow slits in the top of the case. As an extra precaution, a covering of heavy paper was placed over the whole. In manipulating the bars, the observer stood between them and the wall; so that, if the heat from his body succeeded in penetrating the casing, the effect would be to *diminish* the variations observed, and not to increase or to produce them. Numbering the notches in the rack from 1 to 8, the former being the nearest to the wall, the order of arrangement and change was as follows: the standard remained constantly in No. 5; after each set of comparisons, the bar in No. 8 was put in No. 1; each other bar being moved forward one space, except that in No. 4, which

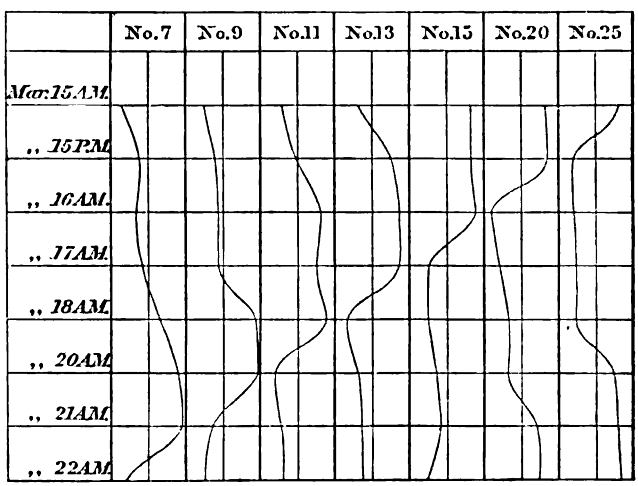


FIG. 2.

was moved to No. 6. Now, it will be seen from the comparisons, that the influence of the cold wall was such, that despite the care with which the bars were protected, and their nearness together, each one had a different length for each position that it occupied.

When the comparisons had continued for two or three days, it was seen that the range of individual results was greater than should be from mere errors of comparison. The true cause was not, however, suspected until the set had been completed by running the bars through each position of the rack, returning to the arrangement with which the set started. The following table gives the relation of the standard to the steel metres, the differences being expressed in microns (one micron equals one-thousandth of a millimetre).

	No. 7.	No. 9.	No. 11.	No. 13.	No. 15.	No. 20.	No. 25.
March 15, A.M.	−8.9	−4.0	−9.4	+2.1	+0.1	−5.3	−10.9
" 15, P.M.	7.4	3.2	8.2	4.7	0.1	5.1	14.6
" 16, A.M.	7.7	2.9	6.3	5.4	+0.5	9.7	14.6
" 17, A.M.	7.2	−2.9	6.6	5.4	−3.3	8.9	14.4
" 18, A.M.	5.8	+0.1	5.8	1.2	3.4	8.3	14.4
" 20, A.M.	4.3	+0.4	10.0	2.0	2.7	8.3	11.4
" 21, A.M.	4.0	−3.4	9.4	2.3	2.3	6.0	11.1
" 22, A.M.	−8.6	−3.9	−9.3	+2.4	−3.4	−5.8	−10.8
	−6.74	−2.48	−8.13	+3.19	−1.80	−7.18	−12.77

While the regularity of the change is apparent in this table, it is much more readily seen in a graphic projection. This is shown in Fig. 2.

The variations from the mean are magnified sixteen hundred times.

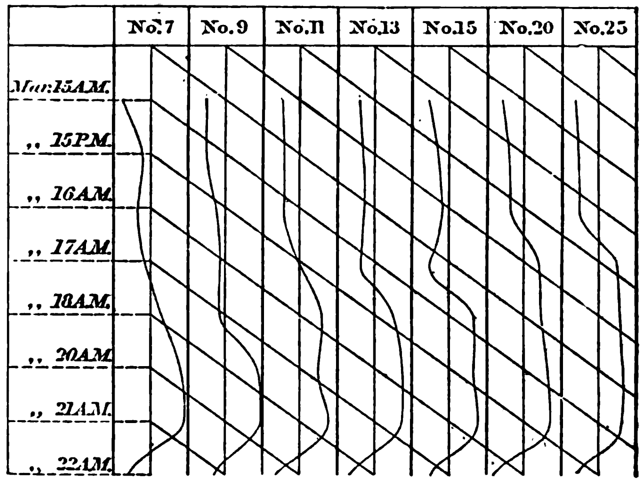


FIG. 3.

In this diagram the vertical lines represent the mean values; and the points in the curves are obtained by using the *differences* from the means as offsets to the right or left, for positive and negative differences. The greatest length of each bar is found when the bar is farthest from the outer wall, and the least length when nearest it. If the differences be shown graphically in parallel projection, the similarity of the curves is still more forcibly shown. This form is given in Fig. 3.

That the variation of temperature within so small a space so carefully protected should have shown so marked an effect, was entirely unexpected. It is susceptible of much more accurate determination through the bars themselves than by the use of thermometers. In the case under consideration, the difference between the extreme positions corresponds to a difference of temperature of about 0.7° F.

To lessen the effect of the influence of the outer wall, other piers were built at double the distance from the wall, and a large screen was placed between the comparator and the wall. The screen was made of a framework of wood, covered on each side with heavy paper. Another series of observations upon the same bars was then begun. The results show the same influence to have been at work; but the effect is very much reduced. A graphic representation is given in Fig. 4.

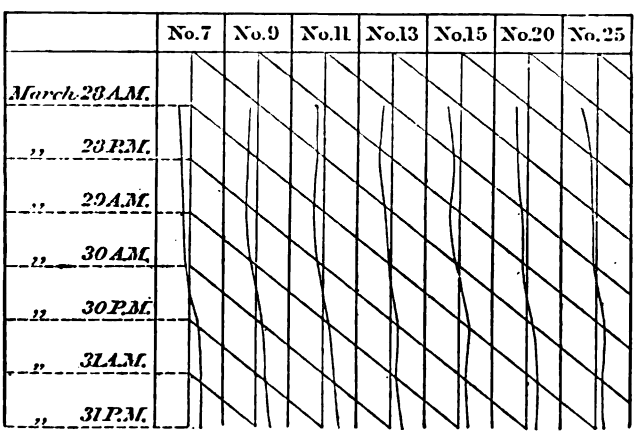


FIG. 4.

This illustration presents in a forcible manner the importance of giving the closest attention to the protection of the standards, where refined accuracy is sought. The influence of the heat from the observer's body is frequently less than that of other causes against which protection is supposed to have been made. With a micrometer capable of measuring with certainty a hundred-thousandth of an inch, we can repeat observations again and again with a range not exceeding this amount, and yet the result will differ from that obtained on another day by a quantity several times larger than the extreme range during a set taken all at once. Any one who has made careful linear or other comparisons will have noticed this. The fact that the bars, while subjected to apparently the same influences, are yet differently affected, is the principal cause of this trouble; and the only way of eliminating the effects from the final result is to so change and alternate the bars in position as that the disturbing influences may operate in turn on the one or the other of the standards under consideration. H. W. Blair.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

V.

It only remains now to describe the de Meritens machine to complete the description of the electric appliances for light-houses.

M. de Meritens has devised several types of machines. The one adapted for light-house purposes, shown in Fig. 16, has the permanent magnets of horseshoe form arranged radially around the axis in a precisely similar manner to the disposition of the field-magnets of the old Alliance machine, which in general appearance it at first sight much resembles.

Fig. 17 is a transverse section of the machine, and Fig. 18 a longitudinal section taken through the axis, so as to show, in both views, the armature ring, and the position of the field-magnets with respect to it.

Figs. 19, 20, and 21 show the details of the armature bobbins marked H, the iron core-pieces, *h h*, and the projecting pole-pieces, which form enlarged ends to the latter, and are marked *g*. In Fig. 19, which represents a section through half the ring, the method of attachment and of coupling up is clearly shown. On reference to Fig. 17, it will be seen that each armature ring, G, is built up of sixteen flattened oval bobbins, H, separated from one another by the projecting pole-pieces, *g;* and around each ring are fixed, radially to the

Fig. 16.

Fig. 17.

[1] Concluded from No. 8.

frame of the machine, eight very powerful compound permanent magnets, each composed

FIG. 18.

of eight laminae of steel. The distance apart of the two limbs of each magnet, as well as the distance between the north pole of one magnet and the south pole of the next, is precisely equal to the distance apart, or pitch around the armature, of the pole-pieces and the coils. The details of the magnets, and their method of adjustment and attachment, are shown in Figs. 22 and 23. Each magnet is built up of eight laminae of steel, each ten mm. in thickness, and are held together tightly by the bolts and nuts, *e d*, the whole being attached to the brass frames, F, which are fixed to the framing of the machine in radial slides, by which the distance from the armature ring can be adjusted with

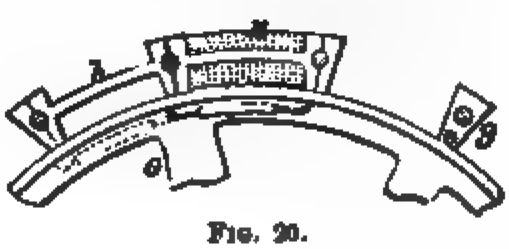


FIG. 20.

FIG. 19. FIG. 21.

great accuracy. The total weight of the forty magnets (see Fig. 16) is about one ton.

The currents from the five armatures are brought together, in two groups, to the four brass collecting-disks, *i*, which are mounted in pairs on an insulated bush, *j*, fixed to the principal shaft of the machine. The details of the collecting-apparatus are shown in Figs. 24, 25, and 26. Against the disks, *i*, are pressed, by means of springs, the four collecting plates or brushes, K′ K′, which are in metallic connection with the attachment screws, K K, of which there are two pairs,— one at each end of the machine (as shown in Fig. 18).

The construction of the armature is very interesting and ingenious. Each of the induction coils shown at H (Figs. 19, 20, and 21) is composed, first, of a flat spool or bobbin of the form marked *h*, and then is wound in a lathe with insulated copper wire 1.9 mm. in diameter, and of which the total weight in the whole machine is from 120 to 130 pounds. The iron cores of these coils are built up of eighty thicknesses of soft sheet-iron one milli-

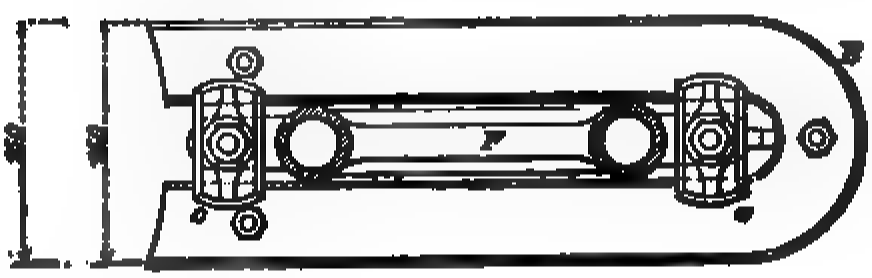


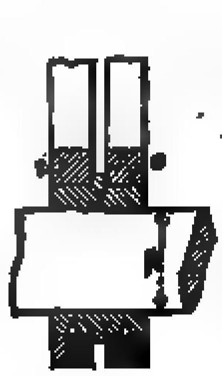
FIG. 22.

FIG. 23.

metre in thickness, and stamped out by a machine. The coils are wound, and attached to the armature wheel by a set of bolts marked *e*, which pass through the projecting lugs, *g*, of the wheel, and through the cylindrical hole formed by the semi-cylindrical grooves in the ends of the iron core-pieces when abutting the one against the other.

The coupling-up of the armature coils is one of the most ingenious features of the machine; for, as the magnets are arranged around the armature in such a way that, in the rotation of the coils, alternate poles are presented to any one bobbin, it follows, that if the bobbins were numbered 1, 2, 3, 4, etc., up to 16, the currents induced in all the even-numbered bobbins would be in one direction, and in all the

odd numbers in the opposite; and it would appear at first sight that these coils could not be connected together in series without the one set of currents neutralizing the other.



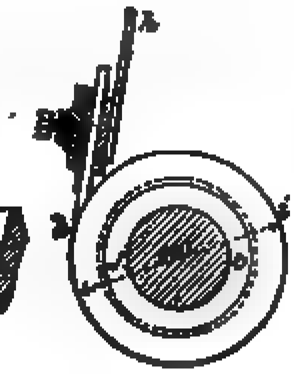


FIG. 24. FIG. 25.

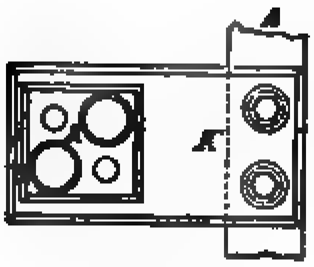


FIG. 26.

But, by connecting the armature coils together in the manner shown in Fig. 27 it will be seen, that although the currents generated in consecutive coils are opposite in direction to one another, yet their combined current transmitted to the collecting-apparatus is in the same direction.

In the early part of this article, attention was drawn to the distinction between the luminous and geographical range; and, in all the installations described, regard has only been paid to the increase of the former, the latter being neglected. This is readily explained by the necessity there was of giving a unit to the new system of lighting the French coasts. There is, however, a point which it will be important to consider, and which may serve to augment the efficiency of the system. In days of heavy fog, when the luminous range is considerably diminished, this diminution would be much less if the geographical range could be increased.

A rather important step has been made in this direction by the use of specially constructed optical apparatus. This apparatus is furnished on the upper part with a series of annular lenses,

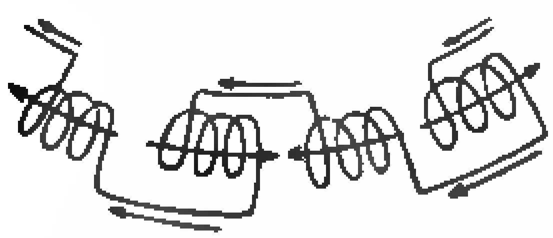


FIG. 27.

whose effect is to project above the light a beam of vertical rays extending to a great height. This beam illumines either the clouds, or the vapor which fills the atmosphere, and is even visible in clear weather, because the air contains enough particles, both solid and vaporous, to allow the phenomenon of diffusion to be produced. These luminous rays thus projected are visible to quite a distance even in foggy nights, and the geographical range is notably increased.

The first application of this system, which has not yet been adopted in France, is about to be made in the Sea of Azof. The ships which cross this sea in the direction of Berdiansk are guided to their point of arrival by a light, which, in the actual state of its installation, could not be seen sufficiently far; and it was decided to apply the system mentioned above. The apparatus recently constructed by Messrs. Sautter and Lemonnier will shortly be installed, and then the efficacy of the system can be judged.

The example thus given by the French lighthouse board has already been followed by other nations. The Ottoman government has studied a plan of electric lighting for the coasts of Turkey. In England an appropriation has been asked to establish, in 1881, about sixty electric lights; and a similar request will be made for the establishment of a hundred lights in 1882.

On account of the time which the complete execution of the project for lighting the French coasts will take, it may be that the experience obtained with the first lights will show some modifications to be made to the adopted plan, and that the lights last made may not have entirely the same dimensions and characteristics as those first built.

In fact, some criticisms have been made by foreign engineers, especially on the diameter of 0.6 met. of the optical apparatus, — a diameter which these engineers consider relatively too small. The faults ascribed to optical apparatus of small diameter are those of heating too readily on account of the proximity of the luminous *foyer*, and also that of being more quickly covered with carbon-dust. We do not, however, believe that there is much to fear from this with apparatus 0.6 met. in diameter; since, for the last twenty years, the lights of la Hève have worked well with apparatus 0.3 met. in diameter. The probabilities are, that future modifications will only be changes in detail, which will not affect the general project.

The above shows the means France has taken to light her coasts, and is a most emphatic recognition of the value of the electric light for that purpose.

The arc-light, however, has two defects which have not been mentioned, — one, a lack of fixity; the other, a deficiency in the red and yellow rays of the spectrum. This lack of fixity is partly due to the carbons not being homogeneous, and partly to faults in the regu-

lators. Improved processes of manufacture have in a great measure removed these defects, but even the best lights will still occasionally flicker.

The red and yellow rays have the greatest penetrating power; and for this reason an oil-light, which is rich in these rays, can be seen farther in foggy weather than an electric light of *equal candle-power*. But the electric light can be made so much more powerful than the best oil-light, that this deficiency can be more than made up; still, it must be borne in mind when the candle-powers of the two lights are compared.

When the French system was adopted, the incandescent electric light had not left the domain of experiment; and even now its luminous intensity is very much less than that which can readily be obtained from an arc-light of moderate dimensions. It possesses, however, the element of remarkable fixity, and is rich in red and yellow rays. No light could be better for a light-house, if it can be produced cheaply, have sufficient luminous intensity, and be made reliable. It will, moreover, dispense with the somewhat complicated and expensive regulators.

It is in this line that the Light-house board of the United States is about to make experiments, and the results obtained will have great interest for the whole world.

DAVID PORTER HEAP.

GEOLOGICAL NOMENCLATURE AND COLORING.

THE following stratigraphical divisions have been provisionally adopted by the international commission of the geological map of Europe. The colors placed against them are those proposed by the directors.

1. Gneiss and protogine. Bright rose-red.
2. Crystalline schists (mica schists, talc and chlorite schists, amphibole schists, and foliated gneiss). Medium rose-red.
3. Phyllites (argillaceous schists, urthonschiefer). Pale rose-red.
4. Cambrian (all fossiliferous beds below the Llandeilo flags; primordial fauna, Taconic). Reddish gray.
5. Silurian, lower fauna (second of Barrande). Dark silk-green.
6. Silurian, upper fauna (third of Barrande). Light silk-green.
7. Devonian, lower. Dark green-brown.
8. Devonian, middle (limestone of the Eifel). Medium green-brown.
9. Devonian, upper. Light green-brown.
10. Carboniferous, lower (culm, mountain limestone, etc.). Blue-gray.
11. Carboniferous, upper (houillier, millstone-grit, etc.). Gray.
12. Permian (dyas), lower (rothliegendes, etc.). Burnt sienna.
13. Permian (dyas), upper (zechstein and equivalents). Sepia.
14. Trias, lower (grès bigarré). Dark violet.
15. Trias, middle (muschelkalk). Medium violet.
16. Trias, upper (keuper and equivalents). Light violet.

16′. *Rhetic*, provisionally (haupdolomit excluded).

17. Jurassic, lower (lias). Dark blue.
18. Jurassic, middle (dogger, kellovien included). Medium blue.
19. Jurassic, upper (malm with tithonic and Purbeck). Light blue.
20. Cretaceous, lower (Neocomien and Wealdian). Dark green.

20′. *Gault*, provisionally.

21. Cretaceous, upper (from the cenomanien). Light green.
22. Eocene (nummulitic, etc.). Orange-yellow.

22′. *Flysch*, provisionally.

23. Oligocene (with the aquitanien). Dark yellow.
24. Miocene (mollasse). Medium yellow.
25. Pliocene. Light yellow.
26. Diluvium. Naples yellow.
27. Alluvium. White.

The subdivisions, 'Rhetic,' 'Gault,' and 'Flysch,' whose affinities are doubtful, will be figured separately in the preparatory work; so that they can finally be joined either to the upper or lower formation, according to the decision reached by the commission of nomenclature.

INDIAN RELICS FROM NEW BRUNSWICK.

THOUGH Indian relics of the ordinary type, such as arrow-heads, axes, gouges, celts, etc., are of common occurrence in this region, as elsewhere, it is extremely rare to find any articles showing other features than those of mere utility; while remains of pottery, so far as I am aware, have, until recently, been entirely unknown. During the last summer, however, my attention was directed to a locality which is one of some interest, not only as containing undoubted relics of this character, but also as illustrating a somewhat unusual mode of occurrence.

The locality in question is that of a small stream or 'thoroughfare' connecting two sheets of water known as Grand and Maquapit Lakes, being the two principal members of a series of lakes and streams covering a considerable area in the central coal-basin of New Brunswick, and tributary to the river St. John. Both

shores of this thoroughfare are low, that intervening between it and the St. John being a mere marsh subject to overflow by the spring freshets; and it is in the soft muds forming the bank of the stream, and thus annually submerged, that the relics in question are obtained.

These are in the form of broken fragments of pottery, of which the largest obtained by me was about two by two and a half inches, and, although not sufficiently perfect to give any definite idea of the form or size of the vessels of which they once formed a part, reveal very clearly, by their composition, texture, and ornamentation, their true nature. As a rule, they are quite firm, looking as if made up of a granular admixture of clay and fine sand, through which, in many specimens, are scattered numerous and rather conspicuous fragments of a lustrous black mica; the whole being hardened, if not vitrified, by heat. The outer surface is usually covered with a reddish or dark-brown glaze, which is less coarse than the material beneath; and upon this surface are stamped or impressed numerous indentations variously arranged in series of parallel, forking, or decussating lines. In one instance only could any thing like definite form be recognized; this being a well-rounded rim, or margin, striped on either side, of what appears to have been a shallow hemispherical bowl, or basin, of some six inches in diameter. During the extreme low water of summer, such fragments may be readily obtained lying on the surface of the hardened mud-beds, but at other times are to be had only by wading.

With these remains of ancient pottery has been found a great variety of stone implements, some of exceptionally perfect design and workmanship, and in two instances elaborately ornamented; while at short distances along the shore, and laid bare by the ploughing action of the ice in spring, are small heaps of flint-chips of all shapes and sizes, with, not unfrequently, broken pebbles or bowlders of quartz from which these have been derived.

The locality is one eminently fitted by its position for the temporary or permanent occupation of the aboriginal tribes, giving easy access by water not only to the St. John River, but to an extensive lake-region, which must have abounded then, as it still does, in game of various descriptions. It has, indeed, been a favorite camping-ground with the natives ever since the time of the first settlement of the country by the Europeans. A curious instance of the contact of the two races has been observed in the finding, during the ploughing of a field, several feet below the surface and not far from the thoroughfare above described, of a large copper caldron, or kettle, evidently of French manufacture, but containing within, besides a quantity of moose-hide, a variety of colored glass beads, some arrow-heads, and a single human molar tooth.

L. W. BAILEY.

Fredericton, N.B., March 4, 1883.

THE PROPERTIES OF CARDIAC MUSCLE, AND THE NATURE OF THE ACTION OF THE VAGUS NERVE UPON THE HEART.

WE printed recently (SCIENCE, No. 2) an account of the researches of Engelmann upon the rhythmic properties of cardiac muscular tissue. Almost simultaneously with the appearance of Engelmann's paper, Gaskell read before the Cambridge (Eng.) philosophical society a communication on the same subject, which has since been published in the proceedings of the society (vol. iv. 277, 1882). Gaskell independently arrives at the same general conclusion as Engelmann in regard to the rhythmical properties of cardiac muscle, but adds much that is new on this and other points. Researches on the hearts of frogs and tortoises, previously published, had led him to the following conclusions: 1°, The beats of the heart represent peristaltic contractions, which start at the venous sinus, and thence travel over the heart; 2°, The peristaltic nature of these contractions is obscured by the fact, that the wave of contraction passes along a tube which is not of the same calibre or of the same properties throughout, consequently the systoles of certain parts (auricles, ventricles) which have bulged out and become prominent, or which by differentiation of structure in the course of development have gained the power of more rapid or forcible contraction, being most conspicuous, give the impression of separate and successive contractions; 3°, Between sinus and auricle, and auricle and ventricle, in these animals, is a connecting band of muscular tissue of feeble contractility and slow conductivity. A systole started in the sinus is thus separated by an apparent interval from the auricular contraction, and this in turn from the ventricular. Gaskell had further proved that one could artificially produce in any region of the heart a zone of slow conductivity, corresponding to the natural sino-auricular or auriculo-ventricular boundaries. If a clamp, for example, be closed not too tightly around the ventricle, then a pause occurs between the contraction of the base and of the apex of that division of the heart. In the tortoise, one then gets, added to the usual succeeding phases of the heart-beat, sinus systole, auricle systole, ventricle systole, — an additional one, due to the separation of the ventricular systole into two distinct contractions, — one of its base, followed, after an interval, by that of the apex. If the clamp be still further tightened, only one contraction of each pair exhibited by the base passes on to the apex of the ventricle; on further tightening, one in three, one in four, and so on, until the block caused by the clamp becomes complete.

The above experiment serving to show how easily, by differences in the conductivity of certain zones of the heart, a primitively continuous peristalsis may be turned into apparently distinct beats of various regions, each separated by an interval from that of the heart-chamber preceding it, the question arises, What is the source of the primitive contraction starting from the venous sinus? Does it lie in nerve-cells, or in the possession by the sinus of muscular fibres, which have a greater tendency than those elsewhere in the heart to exhibit apparently spontaneous rhythmic contractions? Observations on the heart of the tortoise strongly support the latter view, as they show that any section of the heart will, if left to itself, sooner or later contract automatically; the difference in this regard between the venous sinus and the tip of the ventricle is one of degree, and not of kind. The isolated sinus begins beating at once, the auricle a little later, the ventricle later still, and a strip cut out of the tip of the latter only after about four hours. Once the beats in any division commence, they become rapidly more and more regular and powerful, and then continue uniformly for, in some cases, more than twenty-four hours. These facts seem to show that all parts of the tortoise-heart are spontaneously rhythmically contractile, but that the spontaneity is most marked in the sinus, and less and less prominent as the apex of the ventricle is approached. The latter, however, contains no ganglion-cells; and, as we can pass back by gradual steps from its properties to those of the

sinus, it seems pretty certain that the systoles of that part are also primarily due to its muscular tissue, and not to the nerve-cells in it. Recent researches seem to show that all contractile tissue has primitively a tendency to contract rhythmically; and we may perhaps regard the phenomena above described as due to a greater retention of this property in the muscle-fibres of the venous sinus of the tortoise-heart, as compared with those of the ventricles, which have been so modified for the purpose of rapid and powerful contraction as to interfere with the manifestation of the fundamentally inherent tendency to exhibit so-called spontaneous rhythmical beats.

The concluding portion of Gaskell's paper is concerned with the action of a weak, interrupted current upon certain functions of the cardiac muscle, and its resemblance to the action of the vagus nerve. He had already proved, so far as the frog is concerned, that stimulation of the vagus might, under various circumstances, produce directly opposite results, which may be arranged in pairs. It may cause, 1°, Slowing or acceleration of the rhythm; 2°, Diminution or increase of the force of the contractions; 3°, Diminution or (possibly) increase of tone. From subsequent work with the tortoise-heart, he now adds, 4°, Diminution or increase of conductivity in the cardiac muscle. As a corollary to the latter, is to be added the influence of vagus stimulation upon sequence of beats in the successive heart-cavities. When an artificial hindrance to conduction in the cardiac muscle (as by clamping) is interposed, vagus stimulation may either entirely check the transmission of the wave of contraction, or may facilitate it; and similarly it may shorten or lengthen the time-intervals between the contractions of successive heart-chambers. The initial effect of vagus stimulation is often to depress some function: its final and most enduring power is to exalt, intensify, and repair that function. It slows rhythm, but its stimulation makes rhythmic beats last longer than they otherwise would. It diminishes at first the force of the contractions, but its ultimate effect is to improve and sustain the contractile force. It may primarily diminish conductive power, yet in the end it completely restores that power. Gaskell concludes that *the vagus is essentially the trophic nerve of the heart.*

All the above results of vagus stimulation are repeated exactly when an interrupted current not powerful enough to cause contractions is sent through an isolated strip of the apex of the ventricle of the heart of the tortoise. Further: atropine applied to this strip prevents the action of the interrupted current upon it, just as this drug prevents the action of the vagus upon the whole heart. Since the strip contains no nerve-cells, the interrupted current must act directly upon the muscular tissue. Hence it is made probable that the vagus nerve also immediately influences the cardiac muscle without any necessary intervention of nerve-cells; and also that atropine exerts its well-known influence upon the heart, not, as has hitherto been generally assumed, by acting upon the ganglia in that organ, but by immediately influencing the properties of its muscular tissue.

H. NEWELL MARTIN.

THERMOMETER EXPOSURE.

SOME may have been misled by a note on thermometer exposures of the signal-service, which appeared on p. 156 of SCIENCE. The subject is by no means so simple as that note would seem to indicate. Results of temperatures observed in the same neighborhood vary greatly. That the heat of a city, caused by the burning of coal for heating and manufacturing purposes, can affect the temperature of the air an appreciable amount, will be seen to be hardly tenable when it is considered that a breeze of five to ten miles per hour (which is a very light one) will entirely remove the air in the city each hour; that the number of flues by which the heated air is carried out is exceedingly small as compared with the whole atmosphere over the city; lastly, that reliable observations taken in the city and adjacent country show that no such effect is noticeable. Of the last, any one can satisfy himself by consulting observations made in Central-Park observatory and the Signal-office in New-York City. Both of these observatories are fitted up with the very best instruments, and the records may be regarded as reliable as any in the country. The observations for 1878 for the first-named station have been published in the annual report of the New-York meteorological observatory, and, for the second station, in the reports of the chief signal-officer for 1878 and 1879. The following figures show maximum and minimum temperatures for each month of 1878: —

1878.	MAXIMUM.		MINIMUM.	
	Central Park.	Signal-Office.	Central Park.	Signal-Office.
January	51°	51°	7°	9°
February	56°	57°	7°	10°
March	69°	68°	13°	13°
April	76°	75°	42°	40°
May	84°	81°	40°	41°
June	89°	88°	49°	47°
July	94°	94°	63°	61°
August	90°	85°	59°	59°
September	90°	86°	45°	45°
October	80°	78°	39°	39°
November	60°	59°	29°	28°
December	60°	58°	13°	12°
Mean	74.9°	73.6°	33.8°	33.7°

When it is considered that these stations are in such diverse surroundings, with different exposures of instruments, and widely different positions as respects the sea, the above agreements can but appear very remarkable. Abundant similar facts may be easily found. Undoubtedly there are great differences of temperature in the same city or village, due to currents of cold air coming down valleys, differences of exposure of instruments, proximity to large bodies of water, and innumerable other causes exceedingly difficult to guard against. If any one has a doubt as to the uniform results obtained by the signal-service, a glance at the weather-map any day will convince him that isotherms can readily be drawn by using the observations made by the service. If it be claimed that these temperatures on the Atlantic seaboard are too high, it will, at the same time, be seen that this is due in large measure to the proximity of the cities to the sea; and it is necessary to establish the stations there to meet the needs of seafaring men. Experiments are being carried on in England in order to determine the proper manner of exposure of thermometers. Certainly the continental method of placing thermometers at four feet from the ground will hardly give proper temperatures in the spring and autumn in the northern United States so long as there is snow on the ground. What are needed are definite results from careful observations, and not indefinite or general expressions.

LETTERS TO THE EDITOR.

Cracking in ice.

I NOTICED recently a peculiar cracking in ice. Snow had fallen to the depth of about a foot, and had been followed by a cold rain; so that the snow was covered with a layer of ice about three-quarters of an inch thick. The snow immediately under the ice was more firmly packed than that farther down; so that pieces broken out had their under-surfaces covered to a depth of about three inches with closely-packed snow.

The cracks seemed to run over the field irregularly, without regard to the conformation of the surface. In one or two cases they seemed to have a 'radiant' point in a bunch of thistles. Their peculiarity was in the fact, that, for a great part of their extent, they were almost perfect sinusoid curves. Where a crack began, or joined another, it would run quite straight for ten or twelve feet; and then the curves would commence. Most of the curves were of the same size, — about three feet and a half from crest to crest. The two edges of the ice where the crack was were separated about a quarter of an inch to half an inch, and one was uniformly a little higher than the other.

JACOB REIGHARD.

La Porte, Ind., Feb. 10.

Caterpillars eaten by a kitten.

One of our beautiful springs was sadly rifled of beauty and comfort by severe inroads of insects. Elms of noble promise hung around my lawns chiefly as chandeliers for the constant descent of canker-worms. Following the gardener, a pet kitten was attracted by this novel harvest. She ate the caterpillars with infinite relish; and so long as canker-worms hung from the trees, so long did the kitten pass her time in constant leaping after the pendant worms. Among my birds, only my little Black-cap was her rival in rapid voracity. Fed by them as gathered *in bowls*, the mocking-bird was not to be named in comparison with either. M. C. SPARKS.

Badly crystallized wrought iron.

This seems to be such a condition of affairs as is pointed out by Mr. Kirkaldy, who shows that a crystalline fracture is not an indication of the strength of material, but simply of the way in which rupture is effected. A sudden fracture always shows crystalline constitution. In the broken walking-beam referred to by Mr. T. M. Clark (p. 169), the exterior layers doubtless yielded gradually, and the interior layers suddenly; which accounts for the crystalline appearance in the latter case, and the fibrous appearance in the former. I think similar cases will be found reported in Mr. Kirkaldy's excellent work. C. S.

Radiant heat, and the second law of thermodynamics.

The application made by Prof. J. W. Gibbs of the doctrine of radiation (SCIENCE, p. 160) would seem to me in all points to be correct, were it not really a question of the composition of velocities, of which no sufficient account seems to be taken.

To make this clear, suppose a body (such, for example, as a right cylinder) to be projected lengthwise in empty space of uniform temperature, with a velocity equal to that of radiant heat. No heat can then overtake its rear surface: hence its front will receive a double amount, and so have its temperature augmented; thus causing heat to flow along the cylinder from front to rear. But any disturbance of temperatures, such as this, is in apparent contradiction to the proposed application of the doctrine of radiations, which attempts to prove in general that no changes of temperature can arise from the motions of bodies. It is not quite certain that this would also constitute an exception to the second law, although it may well do so, because the radiations encountered may possibly cause a pressure upon the front surface; though it is difficult to see how this can be so in case it is entirely black. This illustration, then, which needs more complete discussion, will at least serve to make evident the necessity of taking into account the velocities of moving bodies in cases in which no such pressures oppose their motion. This is what has been attempted in the brief computation contained in the original paper;[1] and it seems to be admitted, in so far as direct exchanges of radiant heat between A and B are concerned, that more is transmitted in one direction along a line of apertures, $a\ c\ b$, than in the other.

Now, suppose the screens to be non-conducting, and enclosed by a non-conducting cylindrical surface; also let the entire interior of the cylinder and screens be perfectly reflecting. Then no part of the interior can be a continuous source of radiant heat. The enclosed space is also excluded from exchanges with all bodies except A and B, and these only exchange heat through apertures in the screens.

It appears possible, by suitable reflectors moving with the screens, to return to A and B respectively all heat radiated from each which does not pass through the screen c. Now, if a less amount of heat pass in one direction through the apertures $a\ c\ b$ than in the other, then, in order that equilibrium may continue, more heat must pass through c along other lines. But, as there are no sources of heat in the interior, this cannot continue, although true at the start. It is therefore sufficient, in attempting to establish the proposed process as an exception to the second law, to show, as has been attempted, that more heat is transmitted directly from A to B than from B to A; since their exchanges with other bodies and parts of the apparatus may be left out of the account, as was tacitly assumed in the original paper. H. T. EDDY.

Keweenaw-point geology.

On account of certain statements in Prof. R. D. Irving's letter in SCIENCE, March 9, it seems proper to attempt to undeceive him regarding the position of some geologists towards the evidence of the Wisconsin survey, and to make clearer to others the points of discussion. That evidence has neither been ignored nor denied by them; but, while willing to grant its correctness, they deny the conclusions that Irving and his associates have drawn therefrom. Foster and Whitney, in 1850, clearly showed that the copper-bearing traps were a series of lava-flows, between which, in many places, were conglomerate and sandstone beds, composed, in part, of the *débris* of the underlying lava. These detrital deposits were laid down on one lava-flow, and then the succeeding flow was poured over all. Later, Mr. A. R. Marvine brought forward full evidence of the same kind. The present writer also collected similar proof, and, in addition, showed that the traps overflowed and indurated the eastern sandstone.

The structure of the district along a line extending obliquely from Torch Lake to Copper Falls, across the eastern trappean belt, and uniting the sandstone on both sides, is as follows: On the eastern side of Keweenaw Point a series of sandstone and conglomerate beds was laid down, having a gentle but increasing dip as the traps are approached; over these poured the first lava-flow, indurating the underlying

[1] Journ. Frankl. Inst., March.

sandstone; this lava was partially denuded, and buried under a conglomerate composed of its *débris*, mingled with rhyolitic, trachytic, and granitic material. The detritus was also buried under another lava-flow; and this alternating action went on, first with increasing and then with diminishing eruptive activity, until the western sandstones and conglomerates were reached, which were laid down on the last lava-flow. It is probable the lava came from fissure eruptions. Wherever the detritus was deposited on the lava, whether within the trappean belt or on its western side, denudation has taken place, and fragments of the trap (melaphyr and diabase) have been enclosed in the overlying detritus. Unconformability would, of course, thus exist, and the writer has figured such a case; but it is the unconformability that always exists when lava flows on a shore, and is subjected to the denuding action of the waves, and proves nothing regarding the geological age.

The evidence which Irving claims has been ignored, and which he says is "proof absolute that the Keweenawan [copper-bearing rocks] series belongs below the base [Potsdam] of the paleozoic column of the Mississippi" (*Geol. Wisc.*, iii. 23), is principally the finding of a trappean rock at Taylor's Falls, against which rest sandstone and shales holding fragments of the trap and primordial fossils. Excepting the fossils, these are exactly the conditions which are found, and which ought to be found, within the copper-bearing belt, and on its western side; and it proves nothing regarding geological age, but only sequence of time. If such evidence as this is 'proof absolute' of distinct geological age, then there is proof absolute that there are as many different geological formations in the copper-bearing rocks as there are detrital beds enclosed in the traps, and proof that the last lava-flow of any active volcano, reaching the sea, is separated by a distinct age and 'immense unconformity' from the detritus deposited upon it before it is hardly cold. Unconformity of itself proves nothing, unless both formations are sedimentary; for an eruptive rock cannot, from the very nature of the case, be conformable, in the true sense, with any thing. The relations that the old basaltic lavas have, according to Irving, to the western sandstone, are exactly what they ought to have from their origin, as shown thirty-three years ago.

Again: according to the Wisconsin geologists, the Taylor's-falls trap is fifteen miles from any other so-called copper-bearing rocks, and may as well be an azoic rock; for similar ones have been collected by the writer in the granite of the Marquette azoic district. If it is referred to the copper rocks on lithological grounds, the same argument could be used to unite with this series a large part of the basaltic traps the world over. The resemblance between them is, in the writer's opinion, that which any two basaltic lava-flows or dikes have wherever they may have been extruded.

The writer has shown that the first trap on the east overflowed and indurated the eastern sandstone; and he collected specimens showing the induration, the trap, and the trappean detritus in the overlying conglomerate. Therefore Irving's statements, that the eastern sandstone unconformably overlies the trap, and that no trappean detritus occurs in the fragmental rocks, are incorrect; and the published evidence was in his hands several years ago. Irving is mistaken when he says that all the geologists who approached the question from the east felt baffled, as the writings of Foster and Whitney, Selwyn, or myself, give no indications of the kind. It may be mentioned, that in 1850 Foster and Whitney showed that a fault existed along part, at least, of the eastern side of the traps, and that the Bohemian range was a later protrusion. This evidence will explain the apparent unconformity of the traps with the eastern sandstone observed in some places.

For a fuller discussion of the copper-bearing rocks and allied formations, together with the literature down to 1880, the writer would refer to the bulletin of this museum, vol. vii. pp. 1–157.

M. E. WADSWORTH.

Museum of comp. zoöl., Cambridge, Mass., March 15, 1883.

Domestic ducks that fly abroad like pigeons.

In response to Mr. Storer's note under the above heading (SCIENCE, No. 3), I would state that in my boyhood I lived on a plantation in Liberty County, Ga., on which there were a great many domesticated ducks, both mallards and musk-ducks. Many of these latter belonged to the negroes, and were tended with but little care. Near by the negro village there was a swamp full of large trees, and often covered with water. A considerable portion of the swamp was cleared, and annually planted in rice; but many dead cypress (Taxodium) trees still remained standing. This swamp was a favorite resort for wild ducks of all kinds, especially mallards, teal, and summer ducks (wood-ducks). Many domesticated musk-ducks, especially those belonging to the negroes, flew abroad every morning, remained in the swamp (one to two miles distant) all day, and returned at night. Some of them built their nests and reared their young in the swamp, though they never became thoroughly wild.

I never observed this habit, except in the musk-duck. The reason, I think, is plain. In shape, in gait, in flight, and in habits, the musk-duck is very similar to the wood-duck (sponsa). Like the latter, it walks with freer step, it rises, flies, and alights with greater ease and grace, than other species, because the wings are broader and rounder. Like the wood-duck, also, it alights on trees. The dead cypress-trees were a favorite resting-place for the musk-ducks. Like the wood-duck, too, it builds its nest on trees or stumps, and takes down the young when hatched. I have never known the musk-duck to build on the tops of tall cypresses, like the wood-duck, but often on the tops of hollow stumps fifteen to twenty feet high.

JOSEPH LECONTE.

Berkeley, Cal., March 15.

Apparent attractions and repulsions of small floating bodies.

To obviate possible misunderstandings, it may be proper for me to make a few remarks in relation to 'E. H. H.'s' *critique* (SCIENCE, i., p. 43) on my article (*Amer. journ. sc.*, Dec., 1882) on the above phenomena.

I am to blame for whatever ambiguity attaches to the use of the term 'tension' as applied to the explanation of these phenomena. In one instance (that cited) I inadvertently used the expression 'superior *tension*' instead of 'superior *force*.' But inasmuch as in the formal announcement of the capillary principle — which is applied to the case in question, and also in the preceding as well as the succeeding context — it is very clearly indicated that the effective capillary forces (and not the *surface-tension*) are regarded, as inversely proportional to the radii of curvature of the meniscuses, few physicists will, I trust, be misled by the expression.

He does not admit "that a liquid film tends to draw a solid, to which it is attached, toward the centre

of concavity of the film." The most simple and satisfactory proofs of the relative efficiency, as well as the *direction*, of the resultant of these capillary forces, are to be found in the well-known contrary movements of small columns of water and of mercury, when introduced into conical capillary glass tubes placed horizontally. In these cases it is evident, that the effective forces are inversely as the radii of curvature of the terminal meniscuses, and are directed toward their respective centres of concavity.

He maintains, that, if the capillary forces were directed toward the centre of concavity of the film, "the tendency of a column of water raised between two floating bodies by surface-tension would be to lift those bodies: similarly, a column of liquid sustained in a fine tube would tend to lift the tube." Simple mechanical considerations are sufficient to show that he is mistaken in supposing that such a result would follow. Indeed, it is obvious that the elastic reaction of the common meniscus, formed when two such floating bodies are brought near to one another, *does not tend to lift them:* for the *vertical* component of the capillary forces, directed toward the centre of concavity, is exactly counterbalanced by the weight of the adhering liquid elevated between them, while the *horizontal* component is free to draw them together.

So, likewise, the column of liquid sustained in a capillary tube can have no tendency to 'lift the tube;' for it is evident that the weight of the liquid elevated must exactly balance the vertical component of the capillary forces acting at the crowning meniscus within the tube: the horizontal component tends to draw the sides of the tube together.

It is freely admitted that my explanation of this class of phenomena may be imperfect, and may be more or less unsatisfactory; but it seems to me that its shortcomings are not to be found in the directions indicated by the objections put on record by the critic. Such elementary facts as have been elicited above could not appropriately find a place in my paper.

After all, however, the simplest method of reducing this class of phenomena to the reaction of elastic films of liquids is the application (as has been done near the close of my paper) of the principle of Gauss; viz., that this reaction "always tends to reduce the surface to the smallest area which can be enclosed by its actual boundary." JOHN LECONTE.

Berkeley, Cal., March 16, 1883.

A new lecture experiment.

It has long been known, that an iron bar may be permanently magnetized by holding it in the direction of the dipping-needle, and striking it a blow with a hammer. The novelty of this experiment, so far as I am aware, consists in indicating the magnetization of the bar at the instant the blow is delivered. I use for the purpose a reflecting galvanometer (Kohlrausch's pattern), a lantern with detached lens for focusing the reflected beam (or, in the day-time, a *porte lumière*), a piece of gas-pipe 80 cm. long and 45 mm. diameter, and a coil of fine wire large enough to slip freely over the gas-pipe. After carefully demagnetizing the gas-pipe, the coil of wire is connected with the galvanometer, and slipped down against the hand, holding the pipe about 30 cm. from the upper end. With the pipe pointing in the direction of the dipping-needle, a ringing blow is struck on its upper end, and the spot of light on the screen moves promptly from two to four feet, according to the distance of the screen from the galvanometer. A second blow produces only a very small movement compared with the first one. Reversing the gas-pipe, and again striking it, the change of magnetism is indicated by another induced current about equal to the first. The direction of the current is the same as is obtained by moving the coil from the end struck toward the middle of the pipe. By moving the coil along the pipe, before the blow and after it, the induced currents indicate that the temporary magnetism of the pipe produced by terrestrial induction is much weaker than the permanent magnetism produced by the blow. H. S. CARHART.

North-western university,
March 20, 1883.

HOUGHTON FARM EXPERIMENTS.

Houghton Farm. Experiments with Indian corn, 1880-81, with a summary of the experiments with wheat for forty years, at Rothamsted. Cambridge, *Riverside pr.*, 1882. 75 p. l. 8°.

——— *Agricultural physics. Series i. Nos. 1, 2. Meteorology and soil-temperatures.* By D. P. PENHALLOW, B.S. Newburgh, *Ritchie & Hull, pr.* [1883.] 57 p., 5 pl. l. 8°.

BESIDES the intrinsic value which these publications have as reports of carefully conducted experiments, they possess additional interest to all who have at heart the advancement of scientific agriculture in this country, because they are the first public reports of what is here a novel undertaking. The proprietor of Houghton Farm, Mr. Lawson Valentine of New York, has, in effect, established upon it an experiment-station devoted to the scientific investigation of agricultural questions. So far as we are aware, this is the first institution of the kind in the country supported by private munificence, and hence untrammelled by the demand for results of immediate practical utility, and by the mass of miscellaneous chemical work which seriously circumscribes the scientific activity of public experiment-stations. The outcome of this form of the 'endowment of research' will therefore be awaited with much interest.

The first of these reports gives an account of the field-experiments with Indian corn, executed by Dr. Manly Miles in 1880 and 1881. These experiments are, in the main, modelled after the famous Rothamsted experiments of Lawes and Gilbert, and are to be continued through a series of years, with the design of doing for Indian corn what the English experiments have done for wheat and barley. The experimental plots having been laid out and drained in the previous year, a crop of corn was grown in 1880 *without manure*, in order to test the uniformity of the soil and establish a basis for subsequent comparisons. This was followed in 1881 by a crop to which various kinds and quantities of manures were applied on the several plots, certain plots being left unmanured for comparison.

Unfortunately the season of 1881 was extremely dry, and the manures applied produced scarcely any appreciable effect; so that, although various minor results of interest and value were obtained, the main object of the experiments was scarcely at all advanced by the year's work. The most interesting of these minor results is, perhaps, the striking and beneficial effect exercised on the yield of some of the plots by the thorough drainage which they received. Barnyard manure was the only fertilizer which produced any noticeable effect; and this is ascribed rather to its physical action in making the soil more retentive of water than to any direct fertilizing action.

It is evident that circumstances have conspired to render this simply a preliminary report, whose value consists in its account of the plan and methods of the experiments more than in any results yet attained.

Dr. Miles appears to be fully aware of the complex nature of the problems attacked, and to have taken great care to execute all the operations of tillage, planting, cultivation, and harvesting in a uniform manner on the several plots. He is cautious, too, in drawing conclusions, and not in haste to attribute small difference of yield to the effects of different fertilizers, as is too often the case.

His method of comparing the yields of a manured and an unmanured plot is novel and interesting. Instead of assuming the difference between the two to represent the effect of the manures, as is usually done, he first grows a crop on all the plots without manure. In the crop of the succeeding year, he first notes the gain or loss of yield on the unmanured plot, and then assumes, that, if the plot to be compared had not been manured, its yield would have varied to the same extent. Then the difference between the actual yield of the plot and what it would have yielded without manure is regarded as the effect of the fertilizers applied to it. The following example illustrates the method: —

	Manure in 1881.	Yield 1880, unmanured.	Yield 1881.	Would have yielded without manure.	Gain due to manure.
Plot 1 . .	Muriate of potash .	27.1	43.5	36.2	7.3
Plot 3 . .	Nothing .	28.1	37.2	37.2	-

This method of comparison is evidently intended to take account of the natural unevenness of the soil, and it is to a certain extent an improvement over the direct comparison of yields; but it also involves errors of its own, and not only that, but errors of *unknown amount*. Because plot 3 yielded one bushel per acre more than plot 1 in 1880, it is by no means certain, that, in the very different season of 1881, the same difference would have been observed: indeed, it is highly probable that it would not have been. Dr. Miles recognizes this, and designates the 7.3 bushels of our table as 'probable increase produced by manures.' But he gives us no means of knowing whether this amount is within or without the limits of error; that is, whether the manure on plot 1 actually did produce an effect or not. This cannot but be regarded as a serious deficiency in these otherwise valuable experiments; and it is one that no care in the execution of the experiments can do any thing to remove.

A field-experiment with fertilizers involves one of two assumptions, — either that the several plots have exactly the same crop-producing power, or that the differences observed in a preliminary unmanured crop are constant. Neither of these assumptions is true. With the greatest care in the selection of plots, very considerable differences in both respects will show themselves. Such being the case, the scientific conduct of a field-experiment requires that the amount of error involved in the above assumptions shall be determined, to the end that we may know whether the apparent differences in the effects of the fertilizers have any real significance. This may be done by multiplying the number of plots which receive the same treatment, and distributing them uniformly over the experimental field; the only limit to the multiplication being that imposed by practical considerations of the possibility of treating a large number of plots.

In this way it is possible to obtain, not only the average yield of a certain fraction of an acre under particular treatment, but the amount of variation from that average which may be expected in individual cases. This method calls for a multiplication of the manured, as well as of the unmanured plots: it greatly increases the labor of conducting a field-experiment; but the results, once obtained, are reasonably accurate, and *we know how accurate they are.*

This whole subject has recently been very thoroughly discussed by Wagner; and a perusal of his papers[1] cannot fail to be in the highest degree interesting and suggestive to all who contemplate making field-experiments.

[1] *Journal für landwirthschaft*, xxviii. 9; *Landw. versuchsstationen*, xxviii. 123.

The account of the Rothamsted experiments on wheat, from the pen of Mr. Lawes, which is appended to the report, will be read with special interest, as showing what important gains to our knowledge may result from such experiments as those initiated at Houghton Farm.

The papers on agricultural physics contained in the second report relate to local meteorology and soil-temperatures. Under the first of these subdivisions the most interesting statement is, that local predictions, based on the signal-service and on local observations, were made at noon for the succeeding twenty-four hours, with only two per cent of error. Confidence in them was established, and they served an important purpose for the time during which they were issued. The observations on soil-temperatures will, of course, yield more trustworthy averages when based on more than a single season's work; but results of value are already obtained. Eight thermometers with the bulbs immersed in oil within wooden cases, to prevent change of record during their observation, were placed at the surface, and at depths of three, six, and nine inches, and one, three, five, and eight feet, and were observed hourly between seven A.M. and nine P.M., from May to October, 1882, and sometimes throughout the twenty-four hours. The soil was gravel upon hardpan and clay. The observations are elaborately discussed by Mr. Penhallow, who obtains the following results. The penetration of the surface-heat to a depth of three inches requires one and a half to two hours; to one foot, eight to ten hours: hence, at a little greater depth than the latter, the diurnal waves of temperature would be reversed. Hourly change of temperature ceases at about eighteen inches, and daily, near eight feet; but these, as well as the average daily variations, being only for the hours from seven A.M. to seven P.M., need supplementary observations to show their full measure. The use of minimum thermometers would greatly increase the value of the results. Irregularities in the daily temperature-curve are considered first as shown in a diminished total variation ('mean depression of hourly variations'), and, second, as seen in marked irregularities in the curve ('sudden depressions'). The first of these is found to be always connected with rainfall and consequent excess of moisture in the soil, probably aided by absence of direct sunshine; the second generally comes either from a temporary obscuration of the sun, as by a passing cloud, or about as frequently from the reaction after a sudden rise of surface-temperature much above that of the soil below.

Of more interest are the comparative results of observations made in June, three inches below the surface, in one uncultivated, and two plots of cultivated ground, referred to in the report as *a* and *b*. One of the cultivated plots, *a*, had been treated with composted stable-manure; the other, *b*, with an equivalent mixture of commercial fertilizer; and both were planted with corn. The uncultivated ground had the greatest daily range, chiefly from its higher maximum temperature; plot *a* had the least range, as its minimum was $\frac{1}{2}°$ to 1° C. higher than in plot *b*. This diminished variation would seem to result from heat evolved by the decomposing manure.

All the observations are neatly recorded in tables and diagrams. Their only inconvenience arises from the use of even numbers of feet or inches in determining the depths for observation, while the records are kept in fractional centimetres; so that 3, 6, and 9 inches are always rendered 7.6, 15.2 and 22.8 cm. One system or the other should be fully adopted. As the first season of observation includes only the warmer months, studies of frost are not yet published.

FOSSIL ALGAE.

Apropos des algues fossiles. Par le marquis de SAPORTA. Paris, *Masson*, 1882. 76 p., 10 pl. l. 4°.

In a fine imperial quarto, the author critically examines the nature of some impressions described by phytopaleontologists as remains of fossil Algae, but which a Swedish naturalist, Nathorst, in a considerable work published at Stockholm (1881), has considered as representing tracks of invertebrate animals. In his memoir, Nathorst illustrates by a large number of figures the tracks and impressions which the author himself and others have observed, as produced by the movements of small crabs, insects, worms, even of water-currents and waves, upon sand, or soft, muddy surfaces. As points of comparison, the Swedish author gives a list of the works where, to his belief, are represented so-called Algae corresponding to his figures. Among the memoirs quoted in the list are Saporta's *Paléontologie française* (vol. i.) — where, among the Jurassic plants, all the Algae, excepting Itieria and perhaps one or two others, are considered as true tracks — and the *Evolution du règne végétal*, by Saporta and Marion, where most of the impressions described as Algae are regarded as tracks of divers kinds. It is to defend his

position, and that, indeed, of phytopaleontology, that Saporta has prepared a really noble volume. He first examines the conditions of the vegetable remains, their mode of preservation, the evidence of their vegetable nature compared with the impressions produced by animals or mechanical agency. On this subject he adds a note of Dr. Marion, who has followed the same line of research as Nathorst, in carefully studying the character of the cells produced by animal agency, and who points out the great difference between these tracks and vegetable impressions. The second part of Saporta's memoir contains a detailed examination of some types of fossil Algae. The species described are represented, as well as their living related types, with admirable care and precision. Some of the documents from which Saporta has derived valuable assistance are from the works or communications of American authors; Harlania Hallii, among others, is beautifully figured. With few exceptions, all the evidence adduced in the admirable work of Saporta is opposed to the opinions of Nathorst, and renders great service to phytopaleontology.

BOLTON'S QUANTITATIVE ANALYSIS.

The student's guide in quantitative analysis, intended as an aid to the study of Fresenius' system. By H. CARRINGTON BOLTON, Ph.D., Trinity college, Hartford, Conn. New York, *John Wiley & Sons*, 1882. 6 + 124 p. 8°.

THE above title is somewhat misleading; for the book, as stated in the preface, is a series of notes on a system of quantitative analysis, as developed and modified by the author, from a course of instruction originally organized in the School of mines, Columbia college, by Prof. C. F. Chandler. Viewing the book in this light, two things must be taken into consideration, — first, whether the analyses given are typical ones, such as would enable the student, on the completion of the course, to work out by himself the common problems of quantitative analytical chemistry; second, whether the notes given under the various determinations are such as explain, not only the different steps of the process, but also the reasons that necessitate them. The first of these two questions we can answer decidedly in the affirmative. The only criticism that we might make is, that possibly too much attention has been paid to alloys, and not quite enough to complex mineral determinations. The first analysis given is baric chloride, then magnesic sulphate, and other simple salts where no process of separation is necessary. The book then takes up, in well-chosen order, almost all the common alloys and minerals, gives the simpler problems of volumetric work, the determination of carbon, hydrogen, and nitrogen in organic compounds, and many of the most striking commercial tests; such as the examination of sugar, milk, mineral-water, coal, and petroleum. The notes, however, under these different analyses, we cannot consider as perfectly satisfactory. They consist of a short account of the process, with references to Fresenius or the original article, and sometimes a tabulated plan; but no explanation of the various steps is given. If, after each analysis, the reasons why the different reagents had been added, and other numerous details, had been explained, the value of the book would have been much greater; for it is the want of such elucidations in Fresenius that makes his system seem confused and difficult to the young student. As a whole, however, when studied, as intended by the author, in connection with Johnson's translation of Fresenius, or when supplemented by a thorough series of lectures, we can recommend the book as giving a valuable course in quantitative work.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Encke's comet, and a resisting medium in space. — Dr. O. Backlund, in a paper entitled *Kurzer bericht ueber meine untersuchungen ueber die hypothese eines wiederstehenden mittels* (*Mélanges math. et astron.*, vi.), makes the following statement of the results of his researches on Encke's comet: "The investigations hitherto made of the theory of Encke's comet really prove nothing as to the existence of a resisting medium in space. Even if we should succeed by such a hypothesis to explain sufficiently the increase of the mean motion and the decrease of the eccentricity during the period 1819–48, a simple hypothesis like this will not at the same time suffice for the motion of the comet after 1865, as the variation of the mean motion after that time has most probably become different. Not until the period 1865–81, and its connection with the earlier one, have been fully discussed, will it perhaps become possible to find indications of the nature of the unknown forces which act on the comet." — (*Copernicus*, Feb.) D. P. T. [531

Selective absorption of solar energy. — Professor Langley publishes an extended, elaborate, and exceedingly important paper on the selective absorption of solar energy, as determined by observations with the spectro-bolometer at Allegheny observatory, and upon the summit of Mount Whitney. It consists mainly of a statement of results, with comparatively little detail, — perhaps in some cases not quite so much as would be desirable in order to enable the reader to judge how far the numerical conclusions are to be trusted, since probable errors are seldom given. Further papers are promised, however, in which these matters are to be more fully treated.

Prof. Langley's observations cover all the spectrum from about wave-length $0.^{\mu}35$ in the ultra-violet to $3.^{\mu}00$ in the infra-red, — far below the limit reached by any other investigator.

The principal results are the following: 1. The maximum of energy in the diffraction spectrum is near the luminous maximum between the red and yellow, though varying with the sun's altitude. 2. Our atmosphere produces an enormous systematic absorption, increasing continually from the infra-red extremity of the spectrum, where it is comparatively slight, to the ultra-violet, where it is very great. This, however, is not to be taken as denying the existence of remarkble absorption-bands in the infra-red. The observations, in fact, show *four* such bands at wave-lengths $0.^{\mu}94$, $1.^{\mu}14$, $1.^{\mu}37$, and $1.^{\mu}83$, each of them quite as remarkable as the great line A, near the lower extremity of the visible spectrum. 3. The character and color of the sunlight is markedly changed by the atmospheric absorption; so that, to the naked eye placed outside our air, the sun would appear decidedly bluish. 4. The solar constant indicated by the observations is even higher than Forbes's value: it rises to 2.84, and seems not unlikely to reach 3.00. (The units in which the solar constant is here expressed are not *calories* per square *metre* per *minute*, but ten-thousandths of a calory per square centimetre per minute.) 5. The apparatus used was so delicate that all the principal Fraunhofer lines of the visible spectrum showed themselves in the galvanometer readings. 6. The ratio of the luminous to the dark heat is greatly changed by the atmospheric absorption, being much greater outside our atmosphere than within it. The writer adds, "It is probable, however, that the solar spectrum before absorption, though probably weak below the red, *yet extended very much farther into the infra-red than our charts indicate.* We may even regard it as probable that some agent of the atmosphere acts as an almost complete barrier to the entrance or departure of rays below the point charted."

The salient features of the investigation are the exquisitely sensitive apparatus devised for its prosecution, and the new method of deducing the solar constant from pyrheliometer observations at the earth's surface by means of separate co-efficients of transmission determined for radiations of different wave-lengths.

An interesting question arises, also, as to the way in which our atmosphere acts to retain the sun's heat on the earth, in view of the observed fact, that, contrary to all previous suppositions, the air is more transparent to the red and infra-red rays than to those in the upper part of the spectrum. It would seem, as the author suggests, that the air must be almost opaque to rays of wave-lengths below some limit; that limit, however, being below the extreme point reached by his measures. — (*Amer. journ. sc.*, March.) C. A. Y. [532

MATHEMATICS.

Algebraical curves. — M. Noether seeks to establish a thoroughly rigorous foundation for the general theory of algebraical curves in space, and, to this end, proposes to investigate all of the fundamental properties of such curves as can be derived from the general theory of algebraical functions. References are given to the most important papers which have already appeared on this subject; and the author remarks that but two processes have been employed in these earlier papers. The first, developed principally by Cayley, depends upon the representation of these curves by a cone and a 'monoid:' the second seeks to apply the theory of algebraical functions directly to groups of points on the space-curve. The author uses both of these processes; founding them, however, upon firmly established and constantly valid theorems concerning algebraical functions, and shows that the first method, although leading to very general results, is not sufficient for a rigorous establishment of the entire theory. The limits of applicability of the second method are also indicated. The curves treated are without multiple points; and, since they are regarded as general intersections of surfaces, these surfaces can have no multiple points, nor can they have contact along a curve. The first part of the memoir treats of special cases of intersections of surfaces; and the second part, of the intersections of surfaces in general, these surfaces being conditioned only by the fact that they must contain the space-curve under consideration, be destitute of multiple-lines, etc. This general theory has inversely its most general application in the development of the geometry of special surfaces. A brief section is devoted to this latter subject, which the author proposes more fully to develop in a forthcoming paper. The present paper is undoubtedly a most important addition to the existing literature of algebraical space-curves.— (*Journ. reine und angew. math.*, xciii.) T. C. [533

Orthogonal surfaces. — M. Bianchi announces a theorem concerning certain triple systems of orthogonal surfaces; viz., all surfaces of constant negative curvature, $-\frac{1}{R^2}$, give rise to a triple system of orthogonal surfaces, of which one system is formed of surfaces having the same constant negative curvature, and the other two of surfaces which have circles of radius, R, as one of the systems of their lines of curvature. An application is given to the surface formed by the revolution of the tractrix; the Cartesian co-ordinates, x, y, z, of a point in the corresponding triply orthogonal surfaces, are given in terms of three parameters, u, v, w; and the method of generation of these surfaces is described. — (*Atti della r. acad. dei lincei*, vii.) T. C. [534

On Fuchsians. — M. Poincaré, in a series of memoirs presented to the French academy, has treated certain new functions, which he calls 'Fuchsians,' 'Kleinians,' 'theta-Fuchsians,' and 'zeta-Fuchsians.' These functions have a certain analogy to the elliptic and Abelian functions; viz., while these latter functions afford integrals of certain algebraic differentials, the new functions afford means of integrating linear differential equations with algebraic co-efficients. In the present paper the author merely introduces the subject by studying certain properties of Fuchsian groups (*groupes Fuchsiennes*), and expresses the intention of returning later to the study of their consequences from the point of view of the theory of functions. A fuller account of M. Poincaré's paper will be given later, the present brief notice being taken

from the *Probeheft* of the new mathematical journal edited by G. Mittag-Zeffler in Stockholm. — (*Acta math.*, i.) T. C. [535

Definite integrals. — M. Davidoff obtains two very general formulae, depending upon an arbitrary function F (χ) of the nth degree in χ. He claims, by aid of these, to be able to obtain nearly all of the known theorems concerning definite integrals, by making n infinite, and properly choosing the form of F (χ). Several applications are made, based upon the assumption of particular forms for F (χ). — (*Journ. de math.*, 1882.) T. C. [536

PHYSICS.

New method of determining specific gravity of solids. — Professor Munroe, having occasion to ascertain on shipboard the specific gravities of samples of coal, and being prevented by the motion of the vessel from using the balance, devised a procedure which not merely served his purpose, but is susceptible of wide application. Placing a block of coal in a liquid so dense as to float it, he gradually reduced the density by the admixture of a lighter liquid, until the coal *floated immersed*. The homogeneity of the mixture being maintained by stirring, this equilibrium was, of course, reached only when the specific gravity of the liquid became equal to that of the immersed solid. He then measured the specific gravity of the liquid with a common hydrometer. For the flotation of the lighter coals, he used a thick solution of cane-sugar; for anthracite, strong sulphuric acid.

As a test of the accuracy of the results, he afterward repeated the determinations with Jolly's balance, obtaining, —

	By Jolly's Balance.	By Mixture.	Difference.
Anthracite	1.5640	1.560	− .004
Bituminous coal	1.3008	1.310	+ .009
" "	1.3000	1.300	.000
" "	1.2790	1.285	+ .006
Cannel coal	1.1550	1.155	.000
" "	1.1292	1.120	− .009
Lignite	1.0909	1.090	− .001
Mean	. . .	. .	± .004

(*Phil. soc. Wash.; meeting* March 24.) [537

Heat.

Domestic thermometry. — M. Gaston Tissandier considers the errors that are likely to be made in determining the temperature of a room by the usual method of a thermometer hung on the wall. He found that the apparent temperature of a closed room varied from 16° to 21.75°, according to the position of the thermometer. The air in the upper part of the room was much warmer than that near the floor, and the window had a very marked effect on the temperature of the air in its vicinity.

These observations were made with tested thermometers. The errors made with the ordinary domestic thermometer are, of course, much greater.

In order accurately to obtain the temperature of a room, M. Tissandier advises the thermometer to be held at the height of a man for about two minutes at several different points, and the mean of these observations to be taken. — (*La Nature*, No. 508.) C. B. P. [538

Electricity.

Determination of resistance-unit. — Lord Rayleigh recently read a paper before the Royal society, describing experiments conducted by him on the value of the B. A. unit of resistance. Three series of observations were taken, — two by Lorentz's method, and a third, in which the induction coils were separated from the disk so far that the result was practically independent of the radius of the coils. The mean value obtained was

$$1 \text{ B. A. unit} = .98677 \times 10^9 \text{ (C. G. S.)}.$$

The standard of time was a tuning-fork, whose absolute pitch was determined by a new method. — (*Electrician*, Feb. 10.) J. T. [539

Pressure and resistance in carbon. — S. Bidwell read a paper before the Royal society, giving the results of experiments on carbon cylinders making contact at right angles with each other. He proves that changes in pressure produce the greatest proportional effect when the pressure and strength of current is comparatively low; on the removal of the pressure, the resistance returns to about its original value. The passage of a current the strength of which does not exceed a certain limit causes a permanent diminution of the resistance. Similarly, the lessening of resistance due to pressure is magnified by the action of the current. — J. T. [540

ENGINEERING.

The Antwerp water-works. — Mr. William Anderson recently read a paper at the Institution of civil engineers in London, which contains some interesting facts in regard to the purification of water for domestic purposes. Antwerp has 200,000 inhabitants, and until recently its water was derived from shallow wells and from open canals. The well-water, though clear to look at, was for the most part dangerously contaminated by the sewage. The new works take the water from the Nèthe at a point eleven miles from Antwerp. This water was very impure, even after ordinary filtration through sand, as the river flowed through a highly cultivated country, carrying up the drainage of Malines on the flood-tide, and bringing down that of the villages on its upper waters on the ebb. The time during which water could be taken was thus limited to about three-quarters of an hour in each tide. Prof. Bischoff, Dr. Frankland, and Mr. Hatton had shown that finely divided metallic iron had the power of destroying organic impurities, removing color, separating finely suspended matter, and, above all, destroying the germs of putrefaction, of bacteria, and probably those of epidemic diseases. To confirm the laboratory evidence, a pair of filters with a total area of 680 square feet was made at Waelhem; the first filter being placed upon a higher level than the second, and filled with a bed of spongy iron and gravel, mixed in the proportion of one to three, covered with a layer of ordinary filter-sand. In this filter the water would become charged with iron, to eliminate which it was to be exposed to the air, and passed through a second or common sand-filter, in which the red oxide would be deposited. Three months of trial proved so satisfactory that three filters of the same kind were made, having an aggregate area of 31,000 feet, with three sand-filters of the same area. Eighteen months' work has shown that the water remains clear and bright, while the spongy iron showed no signs of deterioration. Dr. Frankland reports favorably upon the chemical condition of the water, and also upon the complete destruction of bacteria and their germs.— (*Van Nostrand's mag.*, March, 1883.) G. L. V. [541

Seasoning wood for musical instruments. — Mr. C. René of Stettin has devised a process for the drying of wood, intended especially for the prepara-

tion of wood for musical instruments, but perhaps otherwise useful. It is described as follows: —

The wooden boards are so arranged in a large iron kettle that gases may freely circulate over their entire surface, and exposed, in the first place, for twelve hours, to the drying effects of hot air. After this the kettle is closed, reheated by the apparatus below, and the air exhausted, when the kettle is filled with oxygen ozonized by electrical sparks passing continually between two points of platina, forming the end-poles of two wires conducted through tubes of glass into the kettle. The ozone is said to act so energetically upon the heated wood, that it consumes the destroying resinous, oily, or other parts in from twelve to twenty-four hours. — (*Engineers' club, Philad.; meeting* March 3.) [542

CHEMISTRY.

(*Organic.*)

Investigations on the unsaturated acids. — For the purpose of defining the lactone formation with greater precision, a series of investigations has been undertaken in Fittig's laboratory, which, although not completed, have yielded valuable results in this direction. By reduction of β-aceto- and β-aceto-isobutyric acids, Gottstein prepared two new caprolactones. A heptolactone was obtained by Young from the reduction of ethylacetopropionic acid, —

$$\begin{array}{l} CH_3 - CO \quad\; COOH \\ \qquad\;\; | \qquad\quad\;\; | \\ \qquad\;\; CH_2 - CH - CH_2 - CH_3 + H_2 = \\ CH_3 - CH - O - CO \\ \qquad\;\; | \qquad\qquad\quad | \qquad\qquad\quad + H_2O. \\ \qquad\;\; CH_2 \;\; - \;\; CH - CH_2 - CH_3 \end{array}$$

An octolactone resulted from the reduction of methylethylacetosuccinic ether. Lactones were derived by Hjelt from allylmalonic, diallylmalonic, and diallylacetic acids. From the formation of paraconic acid from itabrompyrotartaric, it was shown by Beer to be a carboxylic acid of butyrolactone, —

$$\begin{array}{ccccc} & & COOH & & \\ & & | & & \\ CH_2 & - & CH & - & CH_2 \\ | & & & & | \\ O & — & — & — & CO \end{array}$$

Other lactones of an interesting nature were prepared by Jayne and Penfield. Of special interest is a deltalactone obtained by Wolff. In lactones hitherto examined the general structure has been, —

$$\begin{array}{ccccc} | & & & & \\ -\,C & - & CH_2 & - & C\,- \\ | & & & & | \\ CO & & — & & O \end{array}$$

or reduction has taken place between the carboxyl group and a hydroxyl group attached to the third carbon atom from the carboxyl. Starting with sodium-acet-acetic-ether and β-iodpropionic acid, acetoglutaric ether —

$$\begin{array}{l} \qquad\qquad\quad CH_3 - CO \\ \qquad\qquad\qquad\quad | \\ C_2H_5 - O - CO - CH - CH_2 - CH_2 - CO - OC_2H_5 \end{array}$$

— was first prepared. By treatment with hydrochloric acid this substance was converted into γ-aceto-butyric acid ($CH_3 - CO - CH_2 - CH_2 - CH_2 - COOH$), which, by the action of nascent hydrogen in alkaline solution, gave the deltalactone of normal capronic acid, —

$$\begin{array}{ccccccccc} CH_3 & - & CH & - & CH_2 & - & CH_2 & - & CH_2. \\ & & | & & & & & & | \\ & & O & — & — & — & — & — & CO \end{array}$$

Results obtained by Ebert in the study of cumarine, by Fittig and Ebert on cumarilic acid, and by Erdmann on the action of sulphuric acid upon cinnamic acid, were also described. — (*Ann. chem.*, ccxvi. 26.) C. F. M. [543

Constitution of the nitroso-bodies. — The nitrosoketones discovered by V. Meyer in 1877 are now regarded by him and M. Ceresole as containing an oximido-group ($= N - OH$) instead of the group $- N = O$; for example, —

$$CH_3 - CO - CH = N - OH$$

instead of

$$CH_3 - CO - CH - NO.$$

Several facts are mentioned in support of the first form; and, as an experimental proof, the benzyl ether of nitrosoacetone was made and compared with the benzylnitrosoacetone obtained by the action of nitrous acid on benzylacetacetic ether. Since the isomerism of these bodies was established by differences in their physical and chemical properties, the first cannot contain a nitroso-group.

$$CH_3 - CO - C^{NO}_{H} - C_7H_7.$$

Benzylnitrosoacetone from benzylacetacetic ether.

$$CH_3 - CO - C = N\,.\,OH - C_7H_7.$$

Benzylnitrosoacetone from nitrosoacetone.

Whether nitrosoacetone contains the group $C = N - OH$ or the group $C\begin{array}{l}\nearrow NH \\ \;\;| \\ \searrow O\end{array}$ remains to be determined. The authors conclude that true nitroso-bodies are probably produced by nitrous acid when it acts on the group $\equiv CH$; when acting upon the group $= CH_2$, isonitroso-bodies containing the group $- C = N\,.\,OH$ result. — (*Berichte deutsch. chem. gesellsch.*, xv. 3067.) C. F. M. [544

GEOLOGY.

Geology of the vicinity of Havana. — Pedro Salterain y Legarra has published a geological map which shows along the Cuban shore, in the jurisdiction of Havana and Guanabacoa, a narrow strip of modern rocks; then a band twice as wide, which he refers to the miocene. Next to this is a band of about the same width, colored as eocene. The rest is represented as cretaceous, with narrow tongues of eruptive rocks running through it in a general east and west direction, the largest of which begins at Regla. Guanabacoa is situated on it, and it extends eastward to the limit of the jurisdiction. To the south-west, along the Rio Marianao, the cretaceous becomes very narrow; and south of and including Pedroso, the eocene again appears. The first part of the accompanying memoir consists of a brief orographic and hydrographic description of the districts, together with a number of analyses of the water of the Rio Almendares and of various mineral-springs.

Great difficulty was experienced, in studying the geology, from the heavy mantle of vegetable earth, and the consequent distance between outcrops. His classification of the formations is as follows: 1°. The quaternary or recent, containing the reef-formations of corals and zoophytes, detrital, and alluvial deposits. 2°. Post-pliocene, the relations of which to the quaternary or to the upper tertiary pliocene are uncertain. It generally consists of a sandy, whitish-yellow limestone, with many fossils generally identical with living species. In Matanzas a molar of a hippopotamus was found in a similar deposit. 3°. The miocene, which is placed between the overlying madreporic or quaternary and the eocene band. It extends along the northern slope of the first range of hills, and consists of a rock of generally identical character in all parts, a somewhat argillaceous white limestone, generally very fossiliferous, coarse, porous, and rough to the touch. Most of the fossils are casts. Zoophytes are abundant, as in the post-pliocene; but the relative

proportion of mollusks, principally lamellibranchiates, is larger. Echinoderms are also of more frequent occurrence. 4°. The eocene, the most important formation in the island, which serves as a point of departure of comparisons between the formations. It lies at the base of the miocene, and rests uncomformably on the very inclined and dislocated beds of an older system, probably cretaceous. It contributes chiefly to the formation of the first range of hills parallel to the coast. The upper part consists of fossiliferous limestones dipping 10°–12° N.W.; and below are various beds of clay and limestone. A cephalopod (Aturia zigzag Sow.) occurs, with a large number of gasteropods, lamellibranchiates, some echinoderms and corals, and many Orbitoides Mantelli. 5°. The cretaceous, in which no fossils are found. It underlies the tertiary and overlies the western group of mountains, which some geologists have considered jurassic. The general strike of its beds is east and west, and their dip about 50° S. or S.S.E. In this formation occur the numerous deposits of asphalt, which appear to be contemporaneous with certain igneous eruptions, none of which have affected the tertiary.

The eruptive rocks have been called 'Serpentinica formacion,' because serpentine is the prevailing rock in them. The characters of the rock are very variable. The serpentine is frequently associated with diallage, and yellowish-green olivine often abounds in the darker and more compact rock; there is also much oxide of iron and some oligist iron. The centre and highest part of the eruption is often occupied by diorite, then the olivine and diallage serpentine, and outside a talcose serpentine of brilliant lustre.

Lists of the fossils found in the miocene and eocene are given with the localities in which they occur.

M. Fernandez de Castro, in a lecture on the paleontological proofs that the island of Cuba was united to the American continent, says he believes that all the great geological divisions are represented in the island; but he adduces almost no evidence in support of this assertion. Those interested in the subject will find a bibliography of works relating to the geology of Cuba in vol. iii., p. 62. — (*Bol. com. mapa geol. España*, vii.) J. B. M. [545

METEOROLOGY.

Spectrum of the aurora. — Professor S. Lemström, chief of the Finnish meteorologic observatory at Lodan Kylä (lat. 67° 24′ N., long. 26° 36′ E.), has tried a novel experiment for determining practically the nature of the aurora. He placed a galvanic battery with conductors, covering an arc of 900 square metres (98 feet square), on the hill Oratunturi. He calls the arrangement a streaming apparatus. The conductors were constructed of uncovered copper wires, provided at each half-metre with fine erected points. The wire was led in slings to the top of the hill, and reposed on the usual telegraph-insulators. From one end of this wire a covered copper wire was conducted, on insulators, to the foot of the hill (600 feet high), and there joined a plate of zinc interred in the earth. In this circuit was put a galvanometer. Professor Lemström found the hilltop to be generally surrounded by a halo yellow-white in color, which faintly but perfectly yielded the auroral spectrum. This, he states, furnishes a direct proof of the electrical nature of the aurora, and opens a new field in the study of the physical condition of the earth. Further experiments in Enare, near Kultala, on the hill Pietarintunturi, confirm the above results. On Dec. 29, 1882, a straight beam of aurora was seen over the galvanic apparatus. — (*Nature*, Feb. 1.) H. A. H. [546

Meteorologic council of England. — There will be published soon, by the English meteorologic council, 'Contributions to our knowledge of the meteorology of the arctic regions.' These will consist of observations, taken almost entirely by British ships, from 1819 to 1873.

The council has also resolved upon obtaining data for synchronous weather-maps for the Atlantic Ocean for the thirteen months, August, 1882, to September, 1883, inclusive. [Charts for October, during the West-India hurricane season, would be an important addition.] The council publishes 78 per cent of its forecasts of wind and weather as verified. It has also instituted an investigation of the cause and character of London fogs, the best form of thermometer-screen, Stevenson's or Prof. Wild's metallic screen, the best manner of determining moisture in the air, and the motion of the upper air-currents. All these are still in progress. The latter experiments have been tried by firing six-pound shells with fuses of fourteen seconds. The vertical height reached before the explosion was 2,896m. (9,500 feet). The smoke cloud was clearly visible under a blue sky, and remained so for a considerable time.

The council has made inspections of all the first and second class stations. A noteworthy fact has been brought out by the inspector of the stations in England: namely, that at some stations the abnormal deviations of the wind-direction from local causes is very great; e.g., at Shields, the vane points 22° to the right of the true direction for all except southwest winds. — (*Rep. meteor. council Royal soc.*, 1882.) H. A. H. [547

PHYSICAL GEOGRAPHY.

The Gleisen valley, near Munich. — A recent study, by Chr. Gruber, of this dry valley in the Bavarian plain, shows its connection with the period of glacial extension from the Alps, down the valley of the Isar, to the line of morainal hills, when the overflow-streams from the melting ice cut out channels now abandoned. — (*Ausland*, 1883, 76, 87.) W. M. D. [548

Ice-caves. — Professor Fugger read an entertaining paper on ice-caves at the fourth international alpine congress at Salzburg last summer, in which he showed that the common idea of the summer growth and winter melting of the cave-ice is incorrect, although supported by high authority, as the elder Pictet, Murchison, Herschel, and others, and generally accepted in text-books. This error is doubtless based on the coolness of the caves in comparison with summer air, and their apparent warmth in the colder months, as well as on insufficient observations. Equally wrong is the view sometimes suggested, that the ice of caves survives from the glacial period. The grotto of La Baume, near Besançon, was known to contain ice in 1592; but in 1727 it was completely emptied by the duke of Lévi, to supply his army, encamped near by; yet in 1743 the bottom was covered again with ice, and a dozen ice-columns two metres high were formed. It is found by direct measure that the summer temperature of ice-caves is a little above freezing; but in winter it is several degrees below, the cold being derived from air that sinks in from the surface. Water trickles in at the temperature of the enclosing rocks, but is then soon frozen; and, if enough ice accumulates, it will last over the following summer season of melting. This is a simple and sufficient explanation. Summer evaporation has no effective share in producing cold, as the cavern air is very damp. Fifty-six ice-caves are known in the Alps, eight in the Jura and the Carpathians, four in middle Germany, and many more elsewhere.

None are known where the winter, or at least the January temperature, does not average below the freezing-point. The most important previous studies are by Thury, Sur les glacières naturelles (*Bibl. univ. Genève*, 1861), and by Browne, Ice-caves of France and Switzerland (1865). — (*Peterm. mitth.*, 1883, 12.) W. M. D. [549

GEOGRAPHY.

(*Arctic.*)

Notes from the north. — The Russian authorities have established meteorological stations at Mesen and Bereosoff in west Siberia. —— The international station at the mouth of the Lena reached its destination in August, and erected its dwelling on the island of Sagastir, with four observatories connected with it by covered pathways. —— The Russian *savant* Eliséieff is pursuing ethnological studies in Russian Lapland, and reports that there are not in that area more than three hundred individuals of the Lapp race. —— The 'Louise,' after unsuccessful attempts to carry a cargo to the Yenisei in 1881 and 1882, finally returned to Europe with the much-handled cargo, which had, part of the time, been stored at Hammerfest. For some time, at least, it is expected that the commerce of the Weser will flow preferably in any other direction than toward the Yenisei, if, indeed, these repeated failures do not put a quietus on trade by the Karagates. —— The results of the hydrographic investigations carried on during the voyage of the schooner 'Willem Barentz' are exhibited in the December number of the *Annalen der hydrographie* for 1883, by Bogoslavski. —— The 'Jeannette' survivors left Liverpool for New York on the 18th instant. —— A chart of the 'north polar lands' by Berghaus, with special reference to the work of the international polar commission, is on the point of publication by Justus Perthes. The stations will be represented in red, and the limits will extend to latitude 60°. The waters eastward from the Taimyr peninsula have received the name of the Nordenskiöld Sea from the author of the map, which will, as a matter of course, represent the latest researches, and, moreover, will be sold for the inconsiderable sum of one dollar. —— The Danish expedition in Greenland is to be commanded by Lieut. Holm, who will give two years to the work. —— Dr. Boas proceeded to the German station at Cumberland Inlet, with the meteorological party, in order to make a special study of the Innuit. —— Poliakoff, who went in the summer of 1881 to the island of Sakhalin to make collections and explorations for the St. Petersburg academy of sciences, passed most of the winter on the south-east coast, at Taranka, Patience Bay. Rich collections, and a part of his report, with maps, have already been received, and will soon be published. He will now proceed to the western shore of the Gulf of Tartary, and continue his investigations between Sakhalin and Vladivostok. —— An account of Dr. Stejneger's journey and observations in Kamtchatka and the Commander Islands of Bering Sea appears in *Naturen*, — a popular scientific monthly of Christiania, Norway. — W. H. D. [550

(*Europe.*)

Moors of Oldenburg. — The construction of canals through the moorlands of the duchy of Oldenburg has given much accurate information about them, which is summarized by chief inspector T. Schacht. Their area is 1,000 □ km. (about 400 □ miles) in a total surface of 5,376 □ km. The lower moors are perfectly level, and occupy depressions once filled with water. The upland moors are faintly undulating or slightly convex, sometimes climbing fifty feet above sea-level, and only occupy ground that has free drainage even at its lowest point. They begin at some moist locality with the growth of sphagnum, which, by its power of absorbing and holding moisture, spreads over the surrounding surface, and drives out the pre-existing vegetation. The thickness of these deposits sometimes reaches thirty feet. Great quantities of peat are taken from the moors, and hardly any other fuel is used in this region. It serves in brickyards, and even in iron and steel works; one establishment at Augustfehn requiring five to seven tons daily. The moors still in growth are impassable, but the older are of firmer surface. Of the latter, 270 □ km. are under cultivation, and a small part of the remainder is sometimes burnt over for growing buckwheat, filling the air with a dark, penetrating smoke. The moors are underlaid by sand or sometimes clay; and not unfrequently the remains of old forests of fir, birch, alder, hazelnut, and, on the higher ground, of oak, are found beneath the peat. Birch stumps are sometimes found growing on a thin layer of turf, showing an alternation of forest and moor conditions before the latter took final possession of the surface. Roman coins and weapons and the remains of plank roads are found four or more metres below the surface, implying a growth of that amount in two thousand years. Similar moorlands are common throughout northern Germany. — (*Peterm. mitth.*, 1883, 5.) W. M. D. [551

(*Asia.*)

North-eastern Borneo and Sulu islands. — W. B. Pryer, British north Borneo company's resident at Elopura, furnishes a general description of this region and its tribes. One of the chief features of north-eastern Borneo, or Sabah, is a low plain, some four thousand square miles in extent, enclosed by hills and mountains of sandstone and limestone on the north, west, and south. It has a heavy rainfall, and receives also the drainage of the high lands to the west in the form of numerous large rivers, along which there are many native villages in spite of the danger from fever. The higher land is thought probably suitable for European settlement. The forest fauna includes the elephant, rhinoceros, orang-outang, and some twenty kinds of monkeys, besides buffalo, deer, pigs, and bear, and many other animals. The largest orang-outang found measured four feet four inches in height; their appearance is deceptive, as they seem much taller. The adjoining islands of the Sulu archipelago are generally volcanic, though no volcanic rock is found on the part of Borneo visited. The islands are hilly, populous, generally cleared, and fairly well cultivated. They are surrounded by white coral strands, and, with their moderate temperature and pleasant, light breeze, are unusually attractive. The tribes of this region are very numerous. Some interesting details of their customs and condition are given. — (*Proc. roy. geogr. soc.*, 1883, 90.) W. M. D. [552

(*Pacific Ocean.*)

Mindanao. — The account of Dr. J. Montano's ethnographic exploration of this island of the Philippine group includes a few notes on its physical appearance. Its rocks are generally eruptive, partly covered with deposits of coral rock, implying a modern upheaval. Similar coral reefs fringe the shore. Near the northern end of the island is the circular Lake Mainit, about five miles in diameter, apparently situated in an ancient crater with steeply sloping borders. Earthquakes are frequent and violent in its vicinity. The surrounding mountains contain warm springs, and, especially when the atmospheric press-

ure is low, are covered with vapors from these warm waters. Rain is heavy on the eastern coast (winter months), and the rivers are frequently in flood. — (*Bull. soc. géogr. Paris*, 1882, 593; map.) W. M. D. [553

BOTANY.

(General and physiological.)

Effect of electric light on vegetation. — From experiments conducted at the Palais d'industrie during the electric exhibition of August, 1881, P. P. Déhérain concludes that the electric arc emits some rays injurious to vegetation, which are, for the most part at least, arrested by colorless glass. The light is sufficient to maintain mature plants in vegetation for two months and a half, and is decidedly beneficial to plants which obtain only diffuse daylight, but cannot effect the ripening or germination of seeds. — (*Electrician*, Feb. 10.) J. T. [554

Nettles as artillery-plants. — L. H. Bailey, jun., finds, that, under favorable circumstances, Urtica gracilis exhibits an elastic erection of stamens, coupled with dehiscence of their anthers, which scatters the liberated pollen in puffs. The same phenomenon is recorded for this and other genera of Urticaceae by a number of writers. — (*Bot. gazette*, Feb.) W. T. [555

Fertilization of Catalpa speciosa. — According to the observation of one of Prof. Beal's students, only large bumblebees brush anthers and stigma, and so pollinate the flowers while gathering their nectar. The stigma is sensitive, its lobes closing after being touched. The mode of fertilization of this species is similar to that of the common southern species with which it was long confounded. — (*Bot. gazette*, Feb.) W. T. [556

The formation of starch out of sugar. — It is not yet known with certainty what is the first product of assimilative activity in a vegetable cell containing chlorophyll. Among the views most widely held may be cited those of Sachs and of Boehm. The former regards it as highly probable that the first and direct product is starch, while the latter holds that it is one or more of the sugars. As is well known, starch-grains are found in chlorophyll-granules after exposure to light. But Boehm thinks that the presence of starch in the granules of chlorophyll is no proof that this is the first product of assimilation, since it might have been formed there by the changes in other and simpler carbohydrates. That such changes may take place is rendered more than possible by his discovery that starch can be made in chlorophyll-granules out of sugar *artificially* furnished the plant. Nor does it, according to him, make much, if any, difference which of the sugars is used for the experiment. His method of experiment appears to be open to criticism, but is simple and ingenious. In the main, it consists in supplying to cut surfaces of herbaceous parts a dilute solution of sugar, being careful to avoid too great concentration of the liquid. The result of this administration of elaborated food is immediate. Starch-grains appear at once in the chlorophyll-granules, and the leafy shoots keep fresh and active for six weeks. — (*Bot. zeit.*, Jan. 19 and 26, 1883.) G. L. G. [557

(Systematic.)

A new Oxytheca. — An Oxytheca from the Mohave region, California, described by Dr. Parry, is the eighth of that genus, which is now quite polymorphous in its character. This species is especially distinguished by the spreading, several-flowered involucre, which is cleft nearly to the base, the segments closely resembling the bracts. — (*Bull. Torr. bot. club*, Feb., 1883.) S. W. [558

New species of Agrostis. — Two small sub-alpine species of Agrostis are described by Dr. Vasey, — one from the San Bernardino Mountains, California; the other, from Mount Adams, in Washington Territory. The author does not recognize Mount Adams and Mount Paddo as only different names for the same peak. — (*Bull. Torr. bot. club*, Feb., 1883.) S. W. [559

New Passifloreae. — Dr. Masters proposes a new genus (Mitostemma), remarkable for its peculiar corona, consisting of numerous thick thread-like processes arranged in a triple series at the throat of the very short flower-tube, and having the hypogynous stamens separate from the gynophore. Two species are described, from Brazil and British Guiana; also a new species of Tacsonia, and five of Passiflora, one of the latter from Mexico, the rest from tropical South America. — (*Journ. bot.*, Feb., 1883.) S. W. [560

Selaginella tortipila. — Mr. Baker, in the synopsis of the genus Selaginella, which he has commenced, reduces this supposed species of the higher Alleghanies to a form of the very widely distributed S. rupestris. — (*Journ. bot.*, Feb., 1883.) S. W. [561

(Fossil plants.)

Permian Ginkgos and other fossil plants. — Saporta describes a Salisburia, or Ginkgo, from specimens communicated by M. Grand'Eury from the Permian of Russia. The author considers the plant as a representative of the most ancient species of Ginkgo, and calls it Salisburia primigenia; remarking, that, until now, the Ginkgo has not been known lower than the Rhetic. This is contradicted by the discovery made by Profs. Fontaine and White, in the Permo-carboniferous of Virginia, of fine large leaves, very similar to those of Salisburia, described and figured under the name of Saportea Salisburioides and S. grandifolia (*Second geol. survey Penn.*, PP, pl. 38). If M. Saporta has not seen the specimen, he has at least seen these figures of the leaves, and admitted their close affinity to Salisburia, — an affinity supported by the presence of leaves of Baiera in the same strata. The memoir describes also a new species of Nelumbium, from the lignites of Fuveau, Bouches du Rhône, and mentions a number of plants discovered under the volcanic ashes of Kantal, lower pliocene. Some of the specimens represent tertiary types, like Abies intermedia, a new species; Corylus insignis, Heer; Planera Ungeri, Ett.; Acer pseudo-campestre, Ung.; Tilia expansa, Sap.; and Pterocarya denticulata, Web. Of species living at the present epoch, he quotes Salix mauritanica, Def.; Viburnum pseudo-tinus, Sap., nearly identical to Viburnum rugosum, Per.; a Ruscus, like R. aculeatus; a Ranunculus, like R. philonotis; and Fagus sylvatica-pliocenica, whose organs of fructification have been found. The leaves show a gradual passage to the European species, while they are evidently related to the American Fagus ferruginea, Michx. — (*Comptes rendus*, April 3, 10, 1882.) L. L. [562

ZOÖLOGY.

Mollusks.

Report on the mollusks of the north Atlantic. — The Norwegian north Atlantic expedition, under the direction of Prof. H. Mohn, during 1876–78, made, as is well known, valuable researches into the biology, as well as the hydrography, of the deep sea between Norway, Spitzbergen, and Jan Mayen. Sev

eral of their reports have appeared. The last is that of H. Friele on the mollusks, including those belonging to the Buccinidae. It is printed in parallel columns of Norwegian and English, and illustrated by six quarto plates and a map. The paper is practically a monograph of the Buccinidae of the arctic part of the north Atlantic and its shores. The new genus Jumala is described for Fusus Turtoni Bean and Neptunea Ossiani Friele. It is founded on important differences in the dentition. Several species, which had been before but briefly described, are here figured and characterized in detail. Siphonorbis Dalli, S. undulata, Buccinum nivale, B. sulcatum, new species, and a large number of new varieties, are described, — not merely the shell, but, in a majority of cases, the embryo, oötheca, operculum, and dentition, with various anatomical and biographical details. Friele finds, like others who have studied large series, that species, in the old-fashioned sense, can hardly be said to exist in the genus Buccinum; and, indeed, Neptunea is not much better; but the author considers that a certain part of this confusion is caused by hybridization. — W. H. D. [563

Worms.

North-sea annelids. — G. A. Hansen, in Norwegian and English (in parallel columns), gives an account of the annelids collected by the Norwegian North-sea expedition of 1876–78 (Christiania, 1882, 53 p., 7 pl., map, 4°). He criticises Malmgren's method of distinguishing and delimiting genera, of which he thinks Malmgren has made far too many on unimportant characters. He points out the constancy of the bristles: "The type of the bristles is the same in all Polynoae, with the exception of Melaenis Loveni and Polynoe scolopendrina." The scales, in Hansen's opinion, are much more valuable, being characteristically constant in each species. Möbius and Tauber have gone too far in the opposite direction, of 'lumping' Malmgren's species and genera. Tables of distribution are given, from which it is evident that few families are absent from the frigid area, and the species are the same as those found in temperate waters. P. globifera alone indicates that its favorite, if not its sole, habitat is the cold bottom-strata. A number of new species are described. — (*Journ. micr. soc. Lond.*, Feb., 1883, 60.) C. S. M. [564

Australian Aphroditea. — W. A. Haswell publishes a monograph of the Australian species of this annelidan family, wherein he gives descriptions of about thirty species, of which more than half are new. There appear to be two entirely distinct provinces of distribution, — the northern intertropical shores of Queensland, and the temperate coasts of New South Wales and Victoria. As compared with the same group in northern seas, there is no marked distinction of the forms: the species are different, but the genera the same or nearly related. The first part of the paper is anatomical, and contains interesting notes on the structure of the scales. He corrects Williams's mistake of describing the intestinal coeca as segmental organs, — a mistake repeated by Ehlers, — and himself describes the true segmental organs in Polynoe. They are ciliated tubes, opening in a tubercle at the base of the parapodia. Some observations on the sexual organs, the coeca of the intestine, and the pseudhaemal system, are also recorded. The form of the coeca is described. "The interior of the coecum is lined here and there with 'hepatic cells.' These are large spherical or oval cells, with a delicate . . . membrane, and golden-yellow, oil-like contents, with a nucleus, or, more frequently, two or three." Among these yellow cells are others of the same size, but of very different character, containing numerous cells, each enclosing a spherical green body. Haswell thinks these are the young stages of the yellow cells. — (*Proc. Linn. soc. New South Wales*, vii. 250.) C. S. M. [565

Anatomy of Ctenodrilus. — Kennel's valuable monograph of the anatomy of Ctenodrilus is to be supplemented by a memoir on another species of the same genus (C. monostylos) by Zeppelin, who has published a preliminary notice of his results. An abstract will be given here of the final memoir when published. (*Zool. anz.*, vi. 44.) C. S. M. [566

VERTEBRATES.

Third corpuscle of the blood. — Dr. Richard Norris of Birmingham, Eng., claims to have discovered that the white corpuscles of the lymph peel off the body of the cell, setting the nucleus free. The latter then enters the circulation as a colorless disk, which is ordinarily invisible, having the same refractile index as the *liquor sanguinis*. The disk gradually becomes colored by the endogenous secretion of haemaglobin. He then applies this history to set aside a good many established views concerning the physiology and pathology of the blood. He has presented his opinions in an octavo volume illustrated with numerous plates, forming a revolutionary publication (London, 1882). We should *a priori* give little credence to these surprising conclusions, which have been subjected to telling criticisms by Mrs. Ernest Hart. Norris's principal observation was, that, by certain methods of treatment, colorless disks could be found in the blood, and photographed. Mrs. Hart has repeated his numerous and varied experiments, and shows that the methods employed create the colorless disk out of the red corpuscle by removing, in one manner or another, the haemaglobin. The basis of Norris's theories is thus taken away, and with the base fall all the far-reaching deductions built on it. Nevertheless, although Dr. Norris's interpretations cannot be accepted, it should be remembered that he has published a series of careful and useful observations. — (*Lond. med. rec.*, Oct. 15, 1882.) C. S. M. [567

Nerves of the bile-ducts. — Variot has confirmed and extended Gerlach's observations (*Centralbl. med. wiss.*, xxxvi). The author first gives a brief account of the structure of the bile-ducts and gall-bladder. The nerve-fibres on the ducts are rarely medullated. In gold-chloride preparations one sees the large meshes of the submucous nervous plexus of naked fibres. The ganglion-cells lie mostly in the nodes of the plexus, but are also found elsewhere between the fibres; now and then they are clustered into a little ganglion. A second intermuscular plexus, such as Gerlach described, could not be observed. Nothing was learned of the ultimate terminations. The distribution of the ganglia was studied in longitudinal sections through Vater's ampulla and the neighboring part of the ductus choledocus. At the point of junction is found an extension of Auerbach's plexus. Between the two muscular layers lie the ganglia; but nothing corresponding to Meissner's plexus was found; although, at the junction of the intestinal and ductal mucosa, there is a mass of ganglia. The observations were made on man, dogs, and cobayas. — (*Journ. de l'anat. physiol.*, xviii. 600.) C. S. M. [568

Salivary alkaloids. — Gautier found in normal human saliva an alkaloid-like non-nitrogenous substance, forming a crystallizable compound with chloride of gold and platinum. In its physiological actions this alkaloid resembled the post-mortem alkaloids (*ptomaïnes*): injected into animals, it acted like snake-

poison, especially on birds. The directions given for preparing the alkaloid, and information as to the quantity of it necessary to produce lethal results, have, however, been very deficient. Budwin, desiring to obtain further information on the latter point, arrives at results which throw doubt on the whole matter. He finds that fresh extract of 100 cub. cm. of human saliva subcutaneously injected does no harm to frogs, moles, or pigeons. — (*Arch. path. anat. phys.*, xci., 1883, 190.) H. N. M. [569

The influence of heat and cold upon muscles poisoned by veratria. — It has for some time been known, chiefly from the work of V. Bezold, that veratria exercises a remarkable influence upon muscular contractions. A rapid and powerful contraction is followed by an extraordinarily slow relaxation. In the hope that closer study of the veratria muscle-curve might throw some light upon the nature of a muscular contraction, Lauder Brunton and Cash have made a fresh study of it, especially investigating it under different temperatures. Their work, while not giving much information in regard to this primary point, has led to some interesting results. They find that the influence of veratria varies much with the temperature of the muscle experimented upon. Up to a certain limit, heat increases the effect of the drug; cold diminishes it. Exposure to extremes of heat or cold not sufficient to kill the muscle prevents entirely the manifestation of the usual veratria symptoms. The authors point out, that the modifications which temperature-changes bring about in the action of veratria on muscle suggest that temperature may modify the influence of other drugs, not only on muscles, but on nerves and nerve-centres. Accordingly the different action of drugs on different animals, or on the same animal in various physiological and pathological conditions, may be due in part to temperature differences, physiological or pathological, of the organisms to which they are administered. — (*Journ. of physiol.*, iv. 1.) H. N. M. [570

Conditions influencing the amylolytic action of saliva. — Working with saliva previously carefully neutralized, — a precaution which has not been always taken by previous observers, but which is clearly necessary on account of the variable acidity or alkalinity of different specimens of saliva, — Langley and Eves arrive at the following conclusions: 1°. Neutralized saliva converts starch into sugar much more actively than unneutralized. 2°. .0015 per cent HCl distinctly diminishes the amylolytic action of ptyalin. 3°. Sodium carbonate also diminishes the activity of previously neutralized saliva, and more the more of the alkaline salt is present. 4°. .005 per cent HCl has a very obvious destructive influence on ptyalin. 5°. Sodium carbonate has a very slight destructive power, but greatly retards the action of the salivary ferment. 6°. Neutralized saliva converts starch into sugar more quickly in the presence of neutral peptone than in the presence of peptone plus dilute HCl. 7°. The larger the percentage of acid in proportion to the peptone, — that is to say, the more acid unemployed in combining with the peptone, — the more marked the injurious influence of the acid. Even before the peptone is completely saturated with acid, the injurious effect, due apparently to the presence of acid-peptone, becomes obvious. 8°. Ptyalin is destroyed by acid combined with peptone much more slowly than by the same amount of acid without the peptone. 9°. When peptone is present, the deleterious influence of sodium carbonate is greatly diminished. Not merely peptone, however, but myosin, alkali albumen, and acid albumen act in the same protective manner. The authors conclude that all ptyalin is destroyed in the stomach very soon after that first brief stage of gastric digestion in which no free acid is present. — (*Journ. of physiol.*, iv. 18.) H. N. M. [571

Mammals.

Caudal end of vertebrate embryos. — In his studies on the development of Melopsittacus, Braun observed that a constriction is formed around the end of the tail, which leads to the construction of a terminal knob, connected by a thin stalk with the base of the tail. Into this *nodulus caudalis* the chorda and medullary tube originally extend; but they afterward withdraw from it, leaving the nodulus, a ball of mesoderm covered by ephithelium, to be finally resorbed. This discovery led Braun to search for similar structures in mammals, and he now publishes his results. His investigations were made principally on sheep embryos, and observations were also made on those of other species. He finds an homologous structure, having, however, more usually a thread-like form. In sheep it may be readily seen in most cases when the tail is from 1.5 to 3 mm. long. His general results are: 1°. The tail of mammalian embryos consists of two parts, — an anterior or basal vertebrate; and a posterior invertebrate and smaller portion, which, from its usual form, may be called the caudal thread. 2°. The vertebrate portion may be partly or wholly embedded in the body (internal tail), and terminates at the sacral vertebrae in front; the division of the tail which protrudes is the external tail. 3°. The caudal thread contains originally the terminal portions of the chorda dorsalis, the medullary tube, and the caudal gut (*schwanzdarm*). These are the first parts of the thread to be resorbed; the rest disappears later, the epidermal covering lasting longest. 4°. The caudal gut is a rectal coecum; before it is resorbed, it breaks up into single parts, of which those in the tip of the tail endure the longest. 5°. The chôrda dorsalis projects beyond the last vertebra, its ending being often forked or contorted. 6°. The medullary tube reaches to the tip of the tail or the base of the caudal thread, and its posterior end is probably resorbed. Braun further believes that he has found traces of a neurenteric canal in sheep embryos. He adds a discussion of the tail in human embryos. Finally he homologizes with the embryonic caudal thread, the soft coccygeal appendix of Innus pithecus, and similar structures found abnormally in the chimpanzee, orang-outang, and man, and gives citations to prove that the caudal thread exists in human embryos. — (*Arch. anat. physiol., anat. abth.*, 1882, 207.) C. S. M. [572

Mucous layer of the skin. — Ranvier has made sections of the human skin, hardened in bichromate of ammonia (2%) for two or three months, and then with gum and alcohol. In these the intracellular network is well shown by haematoxylin. The fibres of the network project beyond the cell, and establish the union between the cells. In the intercellular spaces these fibres are thicker than within the cells: they have therefore acquired an additional envelope. Ranvier further argues against considering the threads as protoplasm, but maintains that the clear substance in which they are embedded is the true protoplasm in all cells derived from the ectoderm. This is especially maintained for the central nervous system. (His arguments do not appear convincing). — (*Comptes. rend.*, xcv. 1374.) C. S. M. [573

ANTHROPOLOGY.

The archeology of Russia. — Count Ouwarof of Moscow published, in 1881, a work on the prehistoric archeology of Russia. As to paleolithic man,

the author sums up the result of his researches in a few sentences. 1. His existence is completely demonstrated. 2. He had spread himself to the north as far as 33° 35′. 3. The Chelléenne epoch of Mortillet has not yet been met with in Russia. 4. The Mousterian epoch, on the contrary, is well represented, as well in Poland (Zawisza) as in the Crimea (Mérejkowsky). 5. The epoch of Solutré has not been observed. 6. The epoch of La Madeleine has been well identified in Poland and in the Crimea. Regarding the neolithic age, the author believes that in Russia there is no such hiatus separating it from the paleolithic as seems to have existed in France and Belgium. Count Ouwarof has enjoyed and utilized rare opportunities for extensive researches over the vast Asiatic and European territory under the domination of the Czar. — J. W. P. [574

The human fauna of the District of Columbia. — With reference to the former aborigines, Prof. Otis T. Mason stated that the remains were of three kinds, — so-called drift implements on the surface, chipped implements on the surface, and soapstone quarries. While former censuses had stated the population of the district, the health and police records had not been published in such form as to give good results. The death-rate is as follows for seven years: —

	Population.			Deaths.			Death-Rates.		
Year.	Whites.	Colored.	Total.	Whites.	Colored.	Total.	Whites.	Colored.	Total.
1876	106,741	50,859	157,600	2,090	2,072	4,162	19.58	40.74	26.35
1877	109,505	52,870	162,375	2,190	2,014	4,204	20.00	37.39	25.89
1878	112,340	54,960	167,300	2,167	2,068	4,235	19.29	37.63	25.32
1879	115,247	57,053	172,300	2,196	2,113	4,309	19.06	37.03	25.00
1880	118,236	59,402	177,638	2,085	2,121	4,207	17.63	35.71	23.68
1881	121,300	61,760	183,060	2,205	1,931	4,136	18.18	31.27	22.59
1882	124,441	64,212	188,643	2,353	2,218	4,571	18.91	34.54	24.23

In this table should be noticed the preponderance of colored deaths, the diminishing death-rate, and especially the better health of the excessive colored population.

The crime of the district was also discussed, and some very interesting facts elicited. In the census year the arrests were as follows: —

		1879.		1880.	
	Population.	Arrests.	Per cent.	Arrests.	Per cent.
Males . . .	83,578	10,839	.1297	11,432	.1367
Females . .	94,046	1,771	.0188	2,126	.0226
Total . .	177,624	12,610	.0709	13,558	.0763

All births in the district are not recorded, so that it is impossible to draw safe conclusions regarding the natural increase of population. The sources of information, in collating the material for this paper, were the census-office, the board of health, and the superintendent of police. — (*Biol. soc. Wash.; meeting* March 2.) [575

Bandelier's investigations in New Mexico. — The language, manners, and arts of the modern Indians were examined with minute care. The ruins which antedate the sixteenth century, according to architectural characters, are divided as follows: 1. Cave-dwellings; 2. Cliff-houses; 3. One-story buildings of stone, forming scattered villages; 4. Large houses with retreating stories. "There appear to be, in fact, but two types of aboriginal architecture in New Mexico, — the many-storied communal house and the one-story building of stone. The latter is either found in villages on the level ground and on gradual slopes, or clustering on rock-shelves, and scattered in recesses like the so-called cliff-houses. The cave-dwellings appear as an incidental form, resulting from the ease with which the rock was hollowed out, or from the existence of natural cavities, which, from their size and the security of their position, afforded advantages superior to those of independent buildings." — (*Bull. arch. inst. Amer.*, No. 1.) J. W. P. [576

Mohammedans in the world. — A writer in the Missionary herald makes the following calculation of the Mohammedans in the world: Turkish empire, 20,000,000; Persia and the Caucasus, 12,000,000; India, 41,000,000; East Indies, 23,000,000; China, 5,000,000; Egypt, 8,000,000; Morocco, 2,750,000; Algiers, 2,920,000; Tunis, 2,000,000; Tripoli, 750,000; Sahara, 4,000,000; Soudan, 38,000,000; Zanzibar, 380,000; Central Asia, 14,000,000; total, 173,800,000. — (*Miss. herald*, March, 1883.) J. W. P. [577

The manuscript Troano. — After the brilliant feats in paleography of Grotefend and Champollion, — the former in deciphering the cuneiform; the latter, the hieroglyphics of Egypt, — nothing seems too hard for the student of philology. Of all the outstanding languages, the Maya of Yucatan presents the greatest temptation to the decipherer. In the forthcoming fifth volume of Contributions to North-American ethnology, published by Major J. W. Powell, Dr. Cyrus Thomas presents a monograph upon the Manuscript Troano, already published separately, and occupying 237 quarto pages, illustrated by 31 plates and 101 figures. This volume is the result of years of study, and the last word in an elaborated form of many preliminary utterances and publications. In typography, illustrations, and indexes, it realizes our ideal of a book, yielding the maximum of information and pleasure for the minimum of effort on the part of the reader. In an Introduction, by Dr. Brinton of Philadelphia, are clearly set forth the phonetic system of Central-Americans, the description thereof by Spanish writers, references to Maya literature in the native language, the existing codices, and the previous efforts at interpretation that have been made. Dr. Thomas clearly defines his method in his preface: "I have studied the manuscript somewhat in the same way the child undertakes to solve an illustrated rebus, assuming as a stand-point the status of the semi-civilized Indian, and endeavoring, as far as possible, to proceed upon the same plane of thought." The results attained are as follows: 1. The work was a ritual or religious calendar. 2. The figures in the spaces are symbols, or pictographs, relating to religion, habits, occupations, and customs. 3. It was prepared for people living away from the sea. 4. They were sedentary, agricultural, and not warlike. 5. The evidences of human sacrifice are very meagre. 6. The cross was a religious emblem. 7. Although the figures move from right to left in pairs, the characters are in columns, to be read from the top downwards, columns following each other from left to right. 8. There is no rule for the arrangement of parts in compound characters. 9. The characters are not true alphabetic signs, but syllabic; some are ideographic; others abbreviated pictographs. 10. The work was written

about the middle or latter half of the fourteenth century. 11. The Ahau, or Katun, was a period of twenty-four years; and the great cycle, of three hundred and twelve years; also the series commenced with a Cauac instead of a Kau year 12. Brasseur was right in supposing that the work originated in Peten. In a future issue we hope to present a review of this work. — J. W. P. [578

Craniometry for general use. — Confusion of the worst kind exists among the craniologists in the following particulars, — the base line or orienting of the skull, what marks or characters have anthropologic significance, and the comparative value of the various parts. We have even a French school and a German school. Both of these have been simplifying their methods of late. The Germans held a craniometric conference at Munich in 1877 (*Corr.-blatt.*, 1878, No. 7), one in Berlin in 1880 (*Corr.-blatt.*, 1880, 104-106), and finally came to an agreement at Frankfort in 1882. The result of the last meeting now appears (*Corr.-blatt*, No. 1, 1883), signed by the most distinguished craniologists in Germany. A model-chart in blank accompanies the report, with spaces for number, source, sex, age, skull, countenance, and indices. The number of measurements required are very reasonable, and they are not difficult to make. — (*Corr.-blatt. deutsch. ges. anthrop.*, xiv., No. 1.) J. W. P. [579

EGYPTOLOGY.

Art in Egypt. — In a discriminating review of Perrot's great work, Miss A. B. Edwards says, M. Perrot "has so thoroughly entered into the spirit of ancient Egyptian culture, so firmly grasped the central idea of ancient Egyptian belief, that he has been enabled, not only to trace those influences through every ramification of Egyptian art, but, from a purely philosophic stand-point, to survey and treat his subject as a co-ordinate whole. This it is which gives pre-eminent value to the present work. This it is which we here find attempted and achieved for the first time. And, in truth, it is only within the last few years that such a work has become possible." — (*Academy*, Feb. 17.) H. O. [580

Pithom-Succoth. — The Egyptian exploration fund of England has signalized its advent to Egyptian soil by a discovery promising great results. M. Naville, on the suggestion of Maspero, director of the Boulak museum, began exploration at Tel-el-Maschuta, — a heap of ruins beside the Sweet-water Canal, south of the railway, east of and near Mahsamah, and about fifteen miles west of Ismailia. He writes, Feb. 12, 1883, "I have a piece of good news to begin with. Tell-el-Maschuta *is* Pithom, or, in other words, the temple of Tum, in the city or region of Thuku, which Dr. Brugsch has identified with Succoth. . . . I can give it for certain from the inscription of a statue belonging to a priest of the temple." M. Naville also found a Roman milestone with the inscription, —

DD NN VICTORIBVS
MAXIMIANO ET SEVERO
IMPERATORIBVS ET
MAXIMINO ET CONSTANTI . .
NOBILISSIMIS CAESARIBV.
AB ERO IN CLVSMA
MI VIIII P.

'Ero' would be the transcription of Ar (Ari or Aru), which means the storehouse, and which is found on the statue of the priest. His titles are "the chief of the storehouse of the temple of Tem [Tum] of Theku [Thuku]." Reginald Stuart Poole and Miss A. B. Edwards regard this as a momentous discovery. — (*Academy*, Feb. 24, March 3.) H. O. [581

Love-songs. — How the ancient Egyptian young men and maidens confessed their love, and rejoiced or mourned, may be learned from Maspero's translation of the hieratic papyrus of Turin, published in facsimile by Pleyte and de Rossi, pl. 79-82. This had been translated by Fr. Chabas (*Rec. of past*, vi. 156); but a rearrangement of the broken parts of the papyrus has enabled Maspero to gain a clearer view of the whole. Maspero sees a clear resemblance between the Hebrew and the Egyptian conception of love, and suggests that a comparison of the Hebrew with the Egyptian language of love would explain some points now obscure. — (*Journ. asiatique*, Jan.) H. O. [582

Geographical lists of Karnak. — The only text of these lists open to students is the very faulty one in Les listes géogr. des pylones de Karnak, etc., edited by Mariette in 1875. In an open letter to Brugsch, which is accompanied by two pages of facsimiles, Golenischeff offers many corrections of these lists. He says, "While these lists are of the greatest importance, the study of them in the faulty copies in Mariette's Karnak is not to be recommended." — (*Zeitsch. ägyp. sprache*, 3 heft, 1882.) H. O. [583

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Bureau of ethnology.

Explorations in the Mississippi valley. — Mr. P. W. Norris, on behalf of the bureau, devoted last summer to the examination of mounds and other antiquities of the valley of the Mississippi. His explorations were confined chiefly to eastern Iowa and south-western Missouri, though trips were made to Wisconsin, Minnesota, and Mississippi. Among the results of the work, we mention the following: —

Several somewhat extensive groups of effigy-mounds were discovered in north-western Iowa. One of the groups bears a strong resemblance to one referred to in William Pigeon's singular volume.

In the same region ancient earth-works were found in which the enclosing wall is of the form given in De Bry's figures of the Palisades.

From a mound opened in Wisconsin, a copper kettle, silver bracelet, silver rings, and a silver locket were taken, indicating its modern origin. Two new localities of Indian pictographs were found, and the drawings copied.

Besides stone implements, pottery, pipes, and other evidences of aboriginal art usually found in mounds, two very nicely carved statuettes were obtained in Mississippi. Mr. Norris's collection consists of nearly a thousand specimens.

Professor Cyrus W. Thomas is in immediate charge of these mound-explorations; and the work of the past season is represented by a collection of nearly three thousand five hundred specimens.

Department of agriculture.

Results of field experiments with various fertilizers. — Professor Atwater has given the results of a large

number of experiments of a special and general nature, carried on at his suggestion in different parts of the country for the purpose of studying the demands of our chief crops for various fertilizing materials. In a general discussion of the results, he concludes that corn responds but little to nitrogen, being able to gather its small supply from natural sources, and, for this reason, is not to be regarded as an exhausting, but more nearly a renovating crop. It responds, however, liberally to supplies of mineral fertilizers, phosphoric acid or potash being the dominant under different circumstances, depending upon soil and season. Potatoes have been found to respond uniformly to all the fertilizing ingredients; and they have less capacity than corn for gathering from natural sources. The same is apparently true for turnips. For other crops the number of experiments does not justify conclusions. Practically the largest average yield for all crops was obtained with the complete fertilizers. Nitrate of soda, and superphosphate, yield less than potash and superphosphate, which is significant of the value of potash, and the propriety of adding more of it to our fertilizers. Nitrate of soda, and potash, proved the least efficient. Separately, the nitrate of soda was rarely useful, the sulphate of lime frequently, the muriate of potash very often, and the superphosphates generally. Soils vary widely in their capacity for supplying food to crops, and consequently in their demands for fertilizers; and there are many conditions affecting their action after application. The only way to find what a particular soil wants is by careful observation and experiments.

Lawes and Gilbert's paper on the sources of nitrogen in crops, read at the meeting of the American association at Montreal, is appended to Professor Atwater's report. After maintaining that there is much more experimental proof of the fact that the soil is the source of nitrogen for all crops than that any can be assimilated from the air, a comparison is made between the comparatively recently broken-up soils of America and those of England, which have been long under arable cultivation. Analyses of four soils from the west show a much greater percentage of nitrogen than was found in those at Rothamsted; or, in general terms, the surface-soils of our territories are more than twice as rich in nitrogen as the average Rothamsted soil. In the face of this fact, the difficulty arises as to why less wheat can be raised upon the rich soils of the north-west than upon the worn-out soils of England. As far as they are informed, these writers attribute this result to vicissitudes of climate, and lack of care in cultivation.

This conclusion can hardly be considered as satisfactory; and it remains a question worthy of the greatest attention, as also whether these now rich soils are not being impoverished by the present method of cultivation.

NOTES AND NEWS.

— The gold medal of the Royal astronomical society has this year been awarded to Dr. Benjamin Apthorp Gould, for his 'Uranometria Argentina.' In his address before the society, Feb. 9, on the presentation of the medal, the president, Mr. E. J. Stone, lately her Majesty's astronomer at the Cape of Good Hope, and now the director of the Radcliffe observatory at Oxford, made allusion to the number and variety of Dr. Gould's astronomical papers, which treat of almost all branches of the science, and especially to his reduction of D'Agelet's observations, — a work of considerable extent and of great value. All these were not without their influence in guiding the decision of the council in the award of the medal; but their attention was chiefly concentrated on Dr. Gould's direction of the work of the observatory at Cordoba, in the Argentine Republic. The principal part of this work may be considered an extension of Argelander's scale of magnitudes to all the stars which can be seen by a good eye, without instrumental aid, between ten degrees north declination and the south pole, together with a series of charts exhibiting on a stereographic projection the positions of all these stars to the sixth magnitude, and a proposed revision of the boundaries of the southern constellations. This was the work first undertaken by Dr. Gould on his arrival at Cordoba, with four assistants, thirteen years ago. Some indication of the magnitude of the work may be obtained from the fact that the number of estimations made for the formation of the 'Uranometria Argentina' exceeded forty-six thousand. Dr. Gould has carefully discussed the results of these estimations of stellar magnitude, and compared them with nearly all the materials which were available for the purpose; and, in particular, he has compared his estimations of the magnitude of the brighter stars with results obtained from a discussion of the photometric observations of the second Herschel and of Seidel.

The maps published by Dr. Gould are fourteen in number, one of which is a skeleton-map showing the proposed revision of the boundaries of the southern constellations. The materials collected in this uranometry are far more complete and accurate than any which previously existed; and Dr. Gould has therefore been naturally led to discuss their bearing on those great questions of the constitution of our stellar universe which offer so fascinating and inexhaustible a field for philosophical speculation. The results which he has obtained are in general accordance with those of previous investigators of the subject. It appears to be clearly proved that distance is one of the most important factors in producing differences of apparent brightness in the stars; but the agreement between the number of stars of different magnitudes, and the number which might be expected if these changes of apparent brightness depended solely on distance, is not perfect over any large range of magnitudes. There appears to be a decided preponderance in the number of the brighter stars. It is possible that this preponderance may be partially due to the conventional scale of magnitudes not being a truly photometric scale. Dr. Gould has been led, after a careful discussion of his own observations, to infer that the preponderance of the brighter stars is due to the existence of a stellar cluster consisting of some four or five hundred stars, of which our own system is supposed to be a member.

The position of the northern pole of the medial plane of this belt of stars has been fixed by Dr. Gould at R. A. 11 *h.* 25 *m.*, N. P. D. 60°, whilst that of the galactic circle is at R. A. 12 *h.* 41 *m.*, N. P. D. 62° 39′.

— The notes on the progress of astronomy during the past year, brought before the Royal astronomical society at its anniversary meeting, Feb. 9, related to the following subjects: small displacements of the plumb-line; investigations relating to the tides; the micrometric measures of the Harvard-college observatory; double star observations; Oppolzer's 'Syzygientafeln;' the constant of precession; the mass of Jupiter; discovery of minor planets in 1882; M. Gogou on a lunar inequality of long period, due to the action of Mars; the celestial charts of Prof. C. H. F. Peters; Professor Holden's monograph of the nebula of Orion; the Harvard-college observatory catalogue of stars for 1875; Dr. Huggins's photographs of the corona; astronomical photography; Houzeau's 'Bibliographie d'astronomie;' the transit of Venus; the comets of 1882; and Professor Langley's researches on the solar radiation.

— Col. Prejevalsky has given up his projected expedition to eastern Turkestan, and will probably, instead, be sent as chief of a government expedition to determine the boundary between Siberia and Mongolia.

— J. Martin is exploring the mountainous country of Siberia south of Yakutsk. His last report, dated November, mentions excessive cold, with a minimum of − 56° F., in which his party has suffered greatly. In spite of the general snow, he has made some observations on the rocks of the country, but details are not yet given.

— The annual report for 1882 is the latest example of the excellent work done by the Geological survey of New Jersey under the lead of Professor George H. Cook. It contains a well-colored state map (scale six miles to an inch), besides small outline-maps showing the river-basins and the progress of triangulation and topographic work. Chapters are given on the triassic formation; on the iron industry, showing an estimated output of 900,000 tons in 1882, — an excess of 140,000 over 1881, and larger than ever before; on the plastic clays, showing that the generalizations made in the special clay report and map (1878), are verified by recent work; on shore-changes, chiefly by erosive wave-action, proved by comparison of old and new surveys, amounting to two and three hundred yards at several places south of Barnegat Inlet; proved also by the discovery, at very low water after storms on Long Beach, of roots and axe-cut stumps, as well as horse and cattle tracks preserved in the firm sod of old marshes (p. 82); on water-supply, giving important statistics of rainfall, drainage-areas, and analyses; and recommending the boring of artesian wells, which the structure of the Atlantic slope would favor along the seashore, where the surface-water is generally poor. The probable depths at which water-bearing strata would be found are given for several points on the coast. Other topics are also treated. The expenses of the survey have been kept strictly within the appropriation of $8,000 a year.

The chapter on the triassic rocks has special technical value. It is remarkably well illustrated by tinted lithographs by Bien, showing the general triassic landscape at Plainfield, the columnar structure of the trap at Little Falls on the Passaic, the Palisade trap at its intrusive junction with the sandstones at Weehawken (a three-foot horizontal interbedded branch-dike in the lower part of this plate is colored like the sandstone), and the intrusions of trap between the shales at Martin's dock on the Raritan. The latter are much better than any illustrations of the triassic traps yet published. The working hypothesis adopted to explain the peculiarities of this puzzling formation seems open to criticism. The original connection of the New-Jersey and Connecticut sandstone areas is very improbable. Their similarity results rather from similarity of original conditions than from continuity. We believe that further observation will show the parallel Wachung Mountains to be, not intrusions, like the Palisades, but overflows of trap poured out on the sandstones during their formation, and altogether inactive in producing any perceptible share of the well-known monoclinal tilting. The curved form of these trap-ridges, and probably of all the many others of overflow origin in Connecticut, is the result of the trap-sheets having been faintly folded, with their conformably enclosing sandstones, long after their formation, and most likely at the time of general tilting. It is difficult to understand how any eruptive force would 'necessarily' produce such forms. The discovery of a few faults in the sandstones since 1868, when none had been found, gives hope that the origin of the monoclinal structure may some day be better understood. Apart from these somewhat hypothetical matters, an extended description is given of the character and distribution of the triassic rocks, for the purpose of enlisting the aid of local observers, whose contributions are much needed to 'solve the questions still open.' New Jersey is fortunate in having already progressed so far, and in having the road for further work so well marked out.

— Mr. G. Brown Goode has been appointed by the President commissioner to the London fisheries exhibition. Mr. R. E. Earll, Mr. A. Howard Clark, Capt. J. W. Collins, Mr. W. V. Cox, Capt. H. C. Chester, and Mr. Reuben Wood accompany the commissioner. Representatives of the Signal-office, U.S.A., Light-house board, and Life-saving service, have also been detailed for special duty in connection with the exhibition.

— The Marquis Antonio de Gregorio announces from Palermo, Feb. 9, that, if four hundred subscrib-

ers can be obtained, he will publish a Journal of geology and paleontology, which he hopes will become an international magazine, since he will accept articles written not only in Italian, but also in English, French, and German. It is to appear on alternate months, and contain from fifty to a hundred quarto plates a year. The subscription price is fixed at thirty scudi (dollars).

— The fifth annual meeting of the Ottawa field-naturalists' club was held on Tuesday, March 20. The report of the council shows that the club continues successfully the work for which it was organized. Three excursions were held during the summer, and five *soirées* during the winter. The club received during the year many valuable donations and exchanges, and published Transactions (No. 3), consisting of sixty-six closely printed pages, and two good plates. The number of members is a hundred and eight. Sixteen new members have been elected during the year. Notwithstanding the cost of publishing transactions, and increased general expenses, the club has a satisfactory balance on hand. The following officers were elected for 1883–84: president, H. B. Small, M.D.; vice-presidents, R. B. Whyte and Prof. J. Macoun; secretary, W. H. Harrington; treasurer, W. P. Anderson.

— Dr. George M. Steinberg has written a book, soon to be published, on 'Photomicrographs, and how to make them,' which will be illustrated with seventeen heliotype plates.

— In SCIENCE, p. 192, column 1, lines 10, 11, the clause, "the coal next the mouth not partaking of the motion of that farther in the hill," belongs to the preceding, and not the succeeding sentence.

RECENT BOOKS AND PAMPHLETS.

Arnold, G. M. Robert Pocock, the Gravesend historian, naturalist, antiquarian, and printer. London, *Low*, 1883. 8°.

Bonnier, G., et **Leignette**, A. Premiers éléments des sciences usuelles. Leçons des choses: or, argent, monnaies. Paris, *Dupont*, 1883. 36 p., illustr. 12°.

Boston society of natural history. Constitution and by-laws, with a list of officers and members. [Boston], 1883. 35 p. 16°.

Braconnier, M. A. Description géologique et agronomique des terrains de Meurthe-et-Moselle. Nancy, *imp. Berger-Levrault et Cie*, 1883. 444 p., illustr. 8°.

Bradshaw, J. New Zealand as it is. London, *Low*, 1883. 8°.

Broglie, duc de. La science et la religion: leur conflit apparent et leur accord réel; leçon d'ouverture du cours d'apologétique chrétienne professé à l'Institut catholique de Paris. Paris, *imp. Levé*, 1883. 62 p. 18°.

Cadet, F. Lettres sur la pédagogie, résumé du cours de l'hôtel de ville (mairie du 3e arrondissement). Paris, *Chaix, imp.*, 1883. 310 p. 16°.

Caspari. Détermination de positions géographiques en Cochinchine. Paris, *imp. nationale*, 1883. 30 p. 8°.

Cassino, S. E. The international scientists' directory; containing the names, addresses, special departments of study, etc., of amateur and professional naturalists, chemists, physicists, astronomers, etc., in America, Europe, Asia, Africa, and Oceanica. Boston, *Cassino*, 1883. 8+150+299 p. 12°.

Catalogue de la collection archéologique provenant des fouilles et explorations de M. Désiré Charnay au Mexique et dans l'Amérique centrale pendant les années 1880, 1881, 1882, exposée provisoirement au palais du Trocadéro. Paris, *Tremblay*, 1883. 14 p. 8°.

Charles, E. Lectures de philosophie, ou Fragments extraits des philosophes anciens et modernes. 2 tom. Paris, *Belin et fils*, 1883. I., 8+556 p. II., 590 p. 12°.

Charpentier, A. Étude de l'influence de la coloration sur la visibilité des points lumineux. Paris, *imp. Davy*, 1883. 7 p. 8°.

—— Note complémentaire relative à l'influence de la surface sur la sensibilité lumineuse. Paris, *imp. Davy*, 1883. 7 p. 8°.

Church, A. H. Precious stones considered in their scientific and artistic relations; with a catalogue of the Townshend collection of gems in the South Kensington museum. With a colored plate and woodcuts. London, *Chapman*, 1883. 116 p. 8°.

Dauge. Leçons de méthodologie mathématique à l'usage des élèves de l'école normale des sciences, annexée à l'Université de Gand. Gand, *G. Jacqmain*, 1883. 416 p. 4°.

Delage, A. Éléments d'histoire naturelle des pierres et des terrains (programmes officiels du 2 août, 1880), pour la classe de quatrième. Paris, *imp. Martinet*, 1883. 173 p., illustr. 16°.

Eve, H. W., **Sidgwick**, A., and **Abbott**, E. A. Three lectures on subjects connected with the practice of education, delivered in the university of Cambridge in the Easter term, 1882. Cambridge, *Cambridge Warehouse*, 1883. (Pitt press series.) 92 p. 12°.

Fabre, G. Étude sur les eaux minérales de Caprem (Hautes-Pyrénées). Paris, *imp. Davy*, 1883. 56 p. 8°.

Greer, H. The storage of electricity. N.Y., *Coll. electr. eng.*, 1883. 40+14 p. 8°.

Hamard. L'Age de la pierre et l'homme primitif. Lyon, *imp. Waltener et Cie*, 1883. 13+503 p., illustr. 18°.

Hanstein. Le Protoplasma considéré comme base de la vie des animaux et des végétaux. Traduit de l'allemand. Paris, *Coulommiers*, 1833. 132 p. 18°.

Hoffman, F., and **Power**, F. B. A manual of chemical analysis as applied to the examination of medicinal chemicals. Philad., *Henry C. Lea's Son & Co.*, 1883. 628 p. 8°.

Hull, E. Contributions to the physical history of the British Isles. With a dissertation on the origin of Western Europe and of the Atlantic Ocean. London, *Stanford*, 1883. 150 p., illustr. 8°.

Jacques, V. Éléments d'embryologie, leçons recueillies à l'Université de Bruxelles. Bruxelles, *H. Manceaux*, 1883. 108 p., illustr. 12°.

Kengla, Louis A. Contributions to the archeology of the district of Columbia; an essay to accompany a collection of aboriginal relics, presented for the Toner medal, 1882. Washington, *Waters, pr.*, 1883. 4+42 p., 5 pl., map. 8°.

Lorentz, B., et **Parade**, A. Cours élémentaire de culture des bois créé à l'école forestière de Nancy. Paris, *Poitiers*, 1883. 28+721 p. 8°.

Malley, A. C. Micro-photography; including a description of the wet collodion and gelatino-bromide processes; together with the best methods of mounting and preparing microscopic objects for micro-photography. London, *Lewis*, 1883. 142 p. 8°.

Morelle, E. Recherches chimiques sur la bergenite. Lille, *imp. Danel*, 1883. 30 p. 8°.

North Carolina — Agricultural experiment station. Second biennial report of the director, Charles W. Dabney. 1881–82. Raleigh, *State*, 1883. 24 p., pl. 8°.

—— *The same.* [Bulletins.] i.-iv. 3 nos. [Raleigh], 1883. 20, 32, 16 p. 8°.

Page, D. Advanced text-book of physical geography. 3d ed., revised and enlarged by Charles Lapworth. London, *Blackwoods*, 1883. 350 p. 8°.

Pillsbury, J. H. Development of the planula of Clava leptostyla, Ag. N.Y., *Thompson & Moreau, pr.*, 1882. 3 p., 1 pl. 8°.

Report of the scientific results of H.M.S. Challenger. Zoölogy, vol. vi. London, *Longmanns*, 1883. 4°.

Rogers, J. E. T. Ensilage in America; its prospects in English agriculture. London, *Sonnenshein*, 1883. 162 p. 8°.

Rollet, J. Influence des filtres naturels sur les eaux potables. Lyon, *imp. Giraud*, 1883. 16 p. 8°.

Romanes, G. J. Animal intelligence. N.Y., *Appleton*, 1883. (Intern. sc. series.) 14+520 p. 12°.

Scott, R. H. Elementary meteorology. London, *Paul*, 1883. (Intern. sc. series.) 420 p., illustr. 8°.

Teale, T. P. Economy of coal in house fires; or, how to convert an ordinary fire grate into a slow combustion stove at a small cost. London, *Churchill*, 1883. 50 p., illustr. 8°.

White, W. F. Ants and their ways. With an appendix giving a complete list of genera and species of the British ants. London, *Religious tract society*, 1883. Illustr. 8°.

Wild flowers of Switzerland; or, a year amongst the flowers of the Alps. By H. C. W. London, *Low*, 1883. 76 p. 4°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

FRIDAY, APRIL 13, 1883.

THE NEW YORK STATE SURVEY.

SOME of the readers of SCIENCE are doubtless familiar with the work of the state survey of New York, and will be interested in the reports of its progress, which will be published from time to time for the information of our readers. But the work has been going on so quietly that many are unacquainted with the history of the survey, and the scope of its work. It is therefore as an introduction to occasional reports of progress that we publish a short sketch of the survey.

Several governors of New York had in vain called the attention of the legislature to the importance of such a survey. In the autumn of 1875 the matter was taken up by the American geographical society, which caused an investigation to be made into the character of the best existing maps. Having found them grossly erroneous, and productive of grave practical evils, the geographical society appointed a committee to secure, if possible, the necessary legislation to organize a state survey. This resulted in the passage of a law, organizing the survey under the direction of commissioners, who appointed Mr. James T. Gardiner, formerly geographer of the U. S. geological survey, to be director.

The first work of the director was a thorough examination of the evils which the state survey was expected to remedy; and his plan for the work is based on the results of this inquiry.

The report for 1876 showed that "although the boundaries of eleven counties, having over sixty corners, were examined in whole or part, yet only two corners were found marked with any authentic monuments. . . . The north-west corner of Albany county was originally marked by a dead hemlock-tree. This disappeared many years since, and no monument indicates the spot where it stood. A few old blazed trees alone remain as evidence of the western line of Albany county. . . . The original north-east corner of Montgomery county was a stake in a cultivated field. It has disappeared, and nothing marks the point."

Concerning local and private surveys, the observations and recommendations of the report are of importance to the whole country. It says: "The want of a permanent system of landmarks, whose distance and direction from one another are exactly known, renders positions of all lines very uncertain. Starting-points from which the surveyor is expected to begin his work are very often in doubt by many feet: he has, therefore, no object in running lines accurately, as it is evident, that, if the initial point of a survey is wrong, all points on the lines will be wrongly located, even when chaining and compass work are absolutely correct. . . . An examination of the present method of surveying lands must convince any engineer that its necessary imperfections are the principal sources of those annoying and expensive quarrels and litigations about boundaries with which all land-owners are painfully familiar. These troubles are by no means peculiar to American experience. Perishable landmarks and imperfect surveying have produced uncertain boundaries in every civilized country. Throughout Europe and India this evil has been perfectly remedied by basing all land-surveys upon a system of permanent monuments located by accurate triangulation. We must continue to waste force and money in quarrels and lawsuits over uncertain lines, until we apply the only cure which civilized Europe has found permanently satisfactory."

The accuracy of the best maps of the state was next tested, and they were found to represent the towns from one to three miles from where they really are. "If the purpose of maps is to describe truthfully boundary-lines, towns, and topographical features, as they actually exist on the earth's surface, then the maps of this state are proved to be false witnesses; and the sooner their character is known and condemned, the earlier may improvement be looked for."

The report proceeds to show that a sufficient remedy will never be applied through the exer-

tions of local authorities, or the enterprise of private map-publishers: "The radical difficulty with our modern surveys lies not in want of capacity, integrity, or ambition among the local surveyors, but in the want of a system of lines measured with absolute precision, and permanently marked, which can be made a base of all surveys, and can furnish checks at short distances, and keep errors within certain well-defined limits."

A trigonometrical survey of this nature, whenever completed, will be used in a great variety of ways, entirely independent of any topographical mapping that may be founded upon it. In pursuance of this policy, the survey has been confined to trigonometrical work.

The triangulation is based on that of the U. S. coast and geodetic survey, which had been extended across Massachusetts to the Hudson; certain stations on the Hudson River series of coast-survey triangles having been connected both with the New England and Fire Island bases. Comparison of results from these different lines of measurement shows that the positions of points overlooking the Hudson River valley are known with great exactness, and may therefore be used as starting-points for most accurate surveying.

The lines of principal triangulation are being pushed into the settled parts of the state as rapidly as possible, in order to set tertiary stations for use of local surveyors, wherever property is most valuable, and to save boundaries whose loss seems imminent. Principal stations being once established, the subdivision in smaller triangles, and determination of public boundaries, can proceed at separate places whenever demanded by the exigencies of special regions, and can be done at the expense of individuals, towns, and counties.

The Hudson valley is already well supplied with principal stations by the U. S. coast survey. The state survey has therefore planned to lay out a series of principal triangles extending from Albany westward through the central and western counties of the state; and another from the lower part of the Hudson, through what is known as the southern tier of counties. The first of these, or the central series of triangles, begins at the coast-survey stations, Rafinesque and Helderberg; the first being north-west of Troy, and the latter west of Albany on the Hudson River. The distance between these points, which is the base of this system of triangles, is about 36,966 metres. The triangulation beginning at the Hudson runs westward, spanning the valley of the Mohawk River, and the valleys which continue this great depression westward across New York. Along the shore of Lake Ontario, from Oswego to Buffalo, the U. S. lake survey has measured a small but accurate chain of triangles, a part of their main chain along the lakes. With this lake-survey triangulation, the scheme of the state survey was connected south of Oswego; the distance between the lake-survey stations, Victory and Clyde, being the joining line, and, in fact, forming a base from which work was begun on the western part of the state-survey chain, before connection was made with the Hudson River section.

The measurement of the angles of the larger triangles is done with 12-inch horizontal circles divided by Troughton and Simms of London. One of them was, however, mounted by Fauth and Co. of Washington. The Fauth theodolite has three reading microscopes divided to seconds, and a telescope of 23 inches focal length with object-glass of 2½ inches diameter. The Troughton and Simms theodolite has two reading microscopes divided to seconds. The angles of the smaller secondary, and of the tertiary triangles, are measured with 8-inch Troughton and Simms circles with two reading microscopes divided to seconds. These instruments have also vertical circles divided and read in the same way as the horizontal.

A complete system of trigonometrical levelling is carried on in connection with the secondary and tertiary triangulation, the zenith distances being observed with the 8-inch circles. Measurement of the horizontal angles of each class are repeated until the probable errors are within the limits prescribed by the U. S. coast survey and the British ordnance

survey. The secondary stations along the Mohawk valley are from four to seven miles apart. Where tertiary work has been done, the stations are from half a mile to a mile distant from each other.

In the matter of marking stations, the New York survey has departed widely from the method of the U. S. coast survey, which has preserved its points by burying in the ground within eighteen inches of the surface a pot, jug, or other object, leaving no surface mark whatever. The state-survey stations are marked by sinking a hole five feet deep, in the bottom of which is placed an earthen pot of truncated-cone shape, with centre mark, and stamped with the letters 'N. Y. S. S.' The earth is rammed about and above this for about four inches. A granite monument six inches square by four feet long is then placed in the hole, and its centre adjusted over the pot. The upper extremity of the stone, which projects above ground, is dressed, and the same letters and the number which designates the station are cut deeply into it. Diagonal grooves on the top of the stone mark its centre.

The monuments are of one pattern, and from a single quarry. These stones, deeply embedded in the earth, are very difficult to move or destroy without the perpetrator of such an act being detected. They are easily found by local surveyors or others wishing to identify the points. The action of freezing and thawing unequally on the north and south sides of the stones will eventually throw them over toward the south. Any disturbance of this kind can be detected by the edges being out of plumb; and the stone can be recentred over the pot, which, being below frost-line, can never move. In addition to the deeply buried pot and stone, two witness-pots are buried from twelve to eighteen inches deep, and three feet from the station. On their tops are stamped arrows which point to the station.

The work of the survey is carried on by a director and a permanent corps of trained assistants divided into three parties, — two for observing angles of the primary and secondary triangles, and one for signal-building. Assistant O. S. Wilson, formerly of the U. S. northwest boundary survey, and Assistant Horace Andrews, jun., formerly of the U. S. coast survey, have charge of the observing parties; and Assistant O. H. Bogardus, of the signal-building party. In addition to the regular force, from six to nine heliotropers are employed in summer. During the winters the assistants are engaged in reducing the results, and the preparation of maps and reports, in the offices of the survey in the state capitol at Albany.

In the bill providing for the expenses of the state government, an annual appropriation of $15,800 is now made to carry on the survey.

This sketch of the causes which brought about the New York state survey, the purposes for which it was instituted, its guiding policy, its plans, grade of precision, methods, and organization, is essential to a right understanding of the results of the work whose progress will be described hereafter.

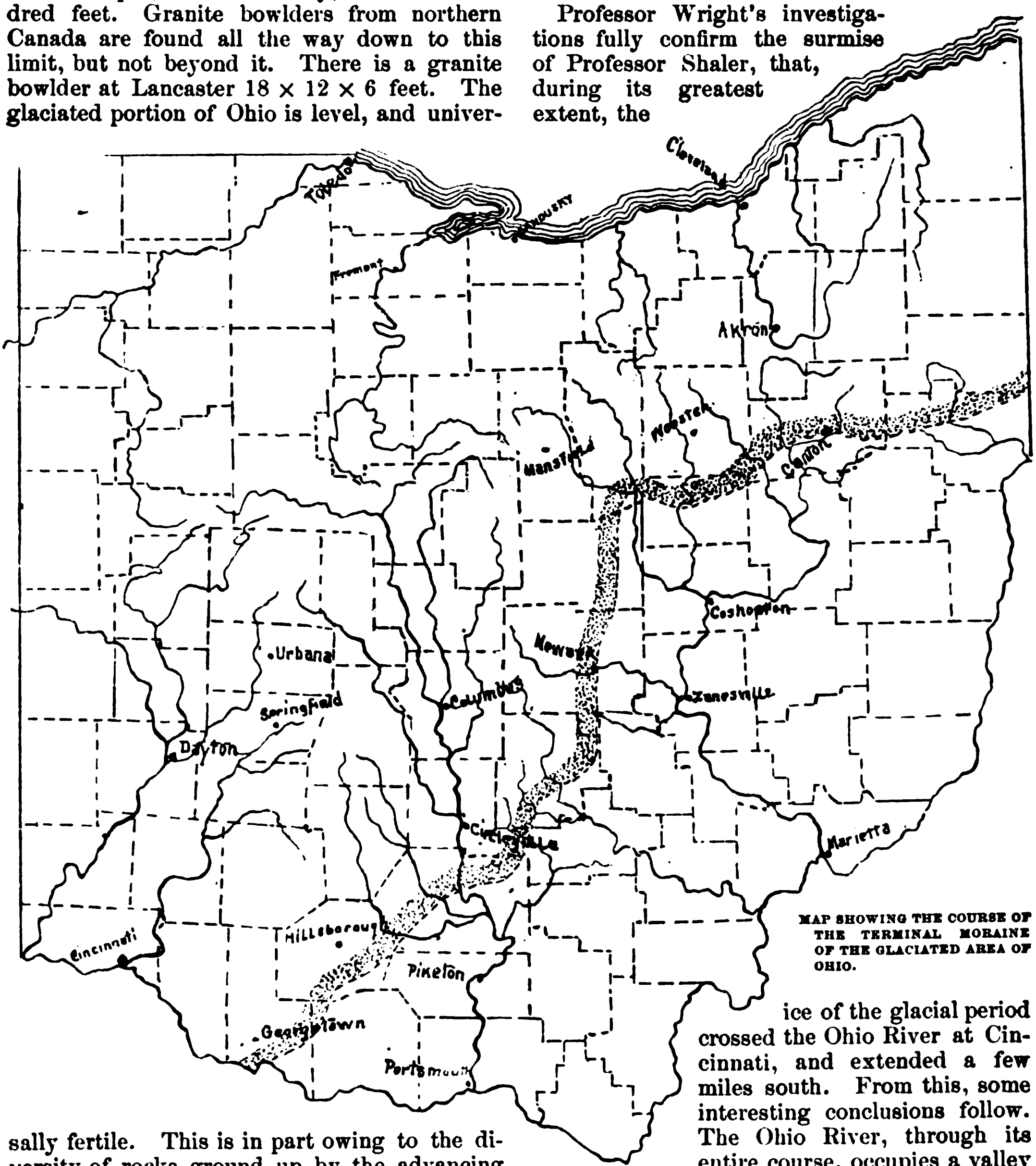
GLACIAL PHENOMENA IN OHIO.

Prof. G. F. Wright of Oberlin read a paper before the Boston society of natural history on the 7th of March, giving the results of his work last summer in determining the exact southern boundary or terminal moraine of the glaciated area of Ohio. The course of this boundary-line is shown upon the accompanying map, and is a continuation of that traced by him and Professor Lewis the previous year across Pennsylvania.

The terminal moraine in Ohio is not everywhere so prominent in its features as it is south of New England, through Cape Cod, the Elizabeth Islands, and Long Island; but the southern boundary of the glaciated region is everywhere very sharply defined, and the limits of the ice can be traced with nearly as much certainty as the shores of the ocean. At various places in Stark, Holmes, Fairfield, and Ross counties there are vast piles of glaciated material at the very limit of the glaciated region. All that portion of Ohio north and west of the line above described is covered with the material which was ground up underneath, and transported by the moving ice. This consists of unstratified fine clay, containing scratched stones and fragments of rock of various kinds from the north. The average depth of this

accumulation (which Dr. Newberry calls 'the grist' of the continental ice-sheet) is about sixty feet; though in places at the very border, as at Adelphi, in Ross county, it is two hundred feet. Granite bowlders from northern Canada are found all the way down to this limit, but not beyond it. There is a granite bowlder at Lancaster 18 × 12 × 6 feet. The glaciated portion of Ohio is level, and universally fertile. This is in part owing to the diversity of rocks ground up by the advancing ice, and in part to the fact that it was pulverized by mechanical action, and is spread evenly over the surface. South of the line the country is cut up into gorges; and, as a rule, the soil is shallow and comparatively sterile. Scratched stones are entirely absent, and granite is found only in the river-valleys. The crop-reports show that the average production of wheat per acre is nearly twice as large in the glaciated as in the unglaciated portion of the state.

Professor Wright's investigations fully confirm the surmise of Professor Shaler, that, during its greatest extent, the ice of the glacial period crossed the Ohio River at Cincinnati, and extended a few miles south. From this, some interesting conclusions follow. The Ohio River, through its entire course, occupies a valley of erosion, having, for more than a thousand miles, cut a gorge from three hundred to five hundred feet deep through the horizontal strata of the coal-formation. During the extension of the glacier into Kentucky, this cañon of the Ohio must have been filled with ice at Cincinnati, forming a barrier in the



MAP SHOWING THE COURSE OF THE TERMINAL MORAINE OF THE GLACIATED AREA OF OHIO.

river nearly six hundred feet in height. This would form slackwater in the Ohio all the way up to Pittsburg, submerging the site of that city to the depth of two hundred and fifty or three hundred feet, and setting the water back far into the valleys of the Alleghany and Monongahela Rivers.

In the extensive gravel-deposits of Ohio, south of the glacial line, no paleolithic implements have as yet been found; but they may be confidently looked for. When they are found, the investigations of Professor Wright and his associates will have important bearings in determining their age; for, in many respects, Ohio affords unrivalled opportunities for determining the amount of erosion which has taken place since the ice of the glacial period withdrew. So far, the evidence points to a later date for the glacial period than that which is advocated by some. The erosion which has taken place since the glacial period is surprisingly small. The streams running over the glaciated surface occupy very shallow valleys. In those rivers whose course was changed by glacial action so as to produce waterfalls the gorges are never more than a few miles long. The period cannot have been extremely long, or these streams would have done more work.

THE WEATHER IN FEBRUARY, 1883.

DESTRUCTIVE floods on the Ohio and tributary waters occurred from Cincinnati and Louisville southward. The water rose higher than ever previously recorded, and property was destroyed estimated as worth $30,000,000. Warnings were issued by the signal-office ten to fifteen days in advance; and merchants had ample time, in most instances, to save their property. The following table exhibits some of the principal facts: —

STATION.	Date water reached the danger-line.	Highest water above danger.		Date water left the danger-line.	Estimated loss.
		Am't.	Date.		
		Feet.			
Pittsburg, Penn.	5	4.8	5	9	$50,000
Marietta, O.	–	–	13	–	50,000
Maysville, Ky.	–	–	12	–	–
Cincinnati, O.	8	16.3	15	22	1,500,000
Lawrenceburg, Ind.	–	–	14	–	–
Vevay, Ind.	–	–	15	–	–
Jeffersonville, Ind.	–	–	16	–	100,000
Louisville, Ky.	8	20.4	16	25	367,000
New Albany, Ind.	9	–	–	–	1,000,000
Shawneetown, Ill.	–	–	–	–	250,000
Cairo, Ill	13	12.2	26	Above at end of month.	–
Memphis, Tenn.	21	Still	rising	28	–
Vicksburg, Miss.	24	"	"	28	–

The last column contains losses only so far as reported. The injuries due to sweeping away of homes, to imperilled health and comfort, and to business delayed, cannot be estimated, but are known to have been very extensive. A very full report is given in the Monthly weather-review of the signal-service.

The month has been colder than the mean for the region west of the Mississippi River. The mean temperature was from 8° to 16° below the normal on the Rocky-mountain plateau; it was slightly below the normal in the north, east of the Mississippi; and above the normal in the south. In the whole country east of the Rocky Mountains the temperature was 0.5° below the normal. The lowest temperature reported was −57°, at Fort Washakie, Wyoming. The rainfall of the Pacific during the winter has not been sufficient to assure a medium wheat-crop in that region. The deficiency was over 4 inches in central California and Oregon in February, and there were larger deficiencies during the previous winter months. This important crop, therefore, depends largely upon the spring rains, which in this region are usually very light. On the other hand, there has been a large excess of rain in the lower lake-region and Ohio valley, the excess in the latter region being 3.86 inches.

Ice dangerous to navigation is slowly drifting south to latitude 43°, between longitudes 45° and 48° W.

The chart on the next page shows the mean distribution of air-pressure and temperature, with the prevailing wind-directions in the United States and Canada. This chart shows very high pressure over nearly the whole country, it being from .1 to .2 of an inch above the mean, except in Florida and southern California. The areas of low pressure traced to the Atlantic have all passed over the St. Lawrence valley, and in no case has the centre of any depression passed to the south of the Ohio valley or middle states.

The total number of storms that have been traced in the United States during each February since 1877 is given below. The mean velocity of the storms, as published in the annual reports of the chief signal-officer, are added for comparison.

Year.	No. of storms.	Mean velocity, miles per hour.
1877	11	26.5
1878	8	27.8
1879	6	33.3
1880	14	39.6
1881	9	43.8
1882	11	42.5
1883	10	36.4
Mean	9.9	35.7

MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, FEBRUARY, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF THE CHIEF SIGNAL-OFFICER.

Ten storm-tracks were traced across the ocean. Of these, a very severe one was felt in the north Atlantic from Feb. 4th to 7th. The winds were of unusual severity, and pressures as low as 28.1 inches were reported by several steamers. This storm, however, was exceeded in extent and severity by most violent gales from the 12th to the 16th, when pressures below 28 inches were recorded.

The total movement of the air on Mount Washington (as indicated by a specially devised Robinson's anemometer) was 32,404 miles, there being 1,825 miles on the 17th. Winds over 100 miles per hour were reported on the 1st, 17th, 26th, and 27th.

Ninety-two cautionary signals were displayed during the month; of which 75, or 81.5%, were justified by winds of at least 25 miles per hour within 100 miles of the station.

The most extensive auroral display was that of the 24th, which was observed on the New-England coast, and from the upper Mississippi to Washington Territory. Auroras are also reported on the 1st, 4th, 5th, 13th, 25th, 27th, and 28th. Prof. D. P. Todd of Amherst reports sunspots most numerous on the 12th and 13th, and least on the 23d and 24th. Unusual earthquake-shocks were experienced on the 4th in Illinois, Michigan, New Hampshire, and Maine. It would seem, that, at the same time, shocks were felt in Agram (Hungary) and Madrid (Spain), as cabled to the New-York Herald. On the 27th another notable shock was felt in Connecticut, Rhode Island, and Massachusetts.

THE LAW OF NUCLEAR DISPLACEMENT, AND ITS SIGNIFICANCE IN EMBRYOLOGY.

DURING his investigations upon the development of fishes, mollusks, and arthropods, the writer's attention has been drawn to the physiological relations of the food-yelk, and the germinal matter of the ova of these forms. A more thorough study of the relations of the two principal materials of the ova of various forms has led him to the conclusion that there is a general law which largely, if not entirely, determines the mode of cleavage apparent in various embryological types. Approximations towards a general statement of the law have been made by Von Baer, Haeckel, Balfour, Whitman, and Mark. My only object is to present what I believe to be some new evidence, and to extend the scope of what appears to be an important generalization.

There are only two clearly marked types of ova. These are, first, the holoblastic or evenly segmenting, and, secondly, the meroblastic or unevenly segmenting. The so-called centrolecithal type is found almost altogether amongst the arthropods, and seems to be in a great measure characteristic of them; but, upon close examination and comparison, I believe it will be found that this mode of segmentation is not so widely different from that met with in the ordinary meroblastic ovum. Whatever may be the opinion with regard to the claims for the recognition of two or three types of segmentation, there can be but two forms of ova discriminated in the animal kingdom; viz., those with, and those without, a food-yelk. Those without food-yelk may be called *homoplastic;* that is, they are composed of but one kind of plasma, all of which is germinal. The first segmentation-nucleus is central in position after fertilization, so that the first cleavage divides the ovum into two equal segmentation-spheres. The result of further segmentation is to divide the total germinal mass into tolerably even-sized spheres. The other type, opposed to the foregoing, may be called the *heteroplastic,* by which it is intended to signify that two or more proteids may enter into the composition of the egg, besides oils in the form of drops. At the time of maturation and impregnation the nucleus is displaced from its original central position to a remarkable extent; in fact, it may be so displaced, as compared with its position in very young eggs, as to appear as if it were altogether superficial or parietal; as in the large ova of fishes, reptiles, and birds. This parietal position of the first segmentation-nucleus is not its original one, as an investigation of the developing ovules in the ovaries of these forms will show; but, even long before the first segmentation-nucleus is formed by the fusion of the male and female pronuclei, we actually find, that in some cases the germinative vesicle has migrated from the centre of the ovum, towards the periphery, without having suffered any marked change in size.

To what cause is this permanent displacement of the egg-nucleus due? We find it to occur only in those ova in which we may detect two sorts of plasma, or in those with germinal matter to which a second or passive quantity of matter has been added during the intra-ovarian growth of the egg. The added material may be in the form of a clearly defined yelk, or it may make its presence manifest only after the beginning of segmentation, by aggregating at one pole or centrally as a less homogeneous, more granular mass than the portion directly involved in the process of segmentation. The

germinal matter, protoplasm of the egg, is the self-motile part. The yelk or deutoplasm, on the other hand, is often composed of spherules, granules, plates, or oval bodies, and is converted by metabolic processes into the first during the later stages of development. The first is the potential part of the egg: the latter is the passive and nutritive. Wherever the yelk is greatly in excess of the germinal matter, the embryo is often far developed, as regards morphological details, before the deutoplasm is nearly all absorbed, its final absorption being accomplished largely through the intermediation of the vascular system of the embryo; as in the ova of fishes, birds, and reptiles. The greater the mass of the yelk in proportion to the bulk of the germ, the more extensive is the permanent displacement of the nucleus from its original central position as observed in the young ovicell. The displacement of the nucleus, or germinative vesicle, would then appear to be due to the development of the yelk as a deposit of material of a lower grade of differentiation than the germinal protoplasm in the central part of the egg, as in meroblastic and centrolecithal ova, from the central portion of which the nucleus has been repelled, and taken up into the germinal matter.

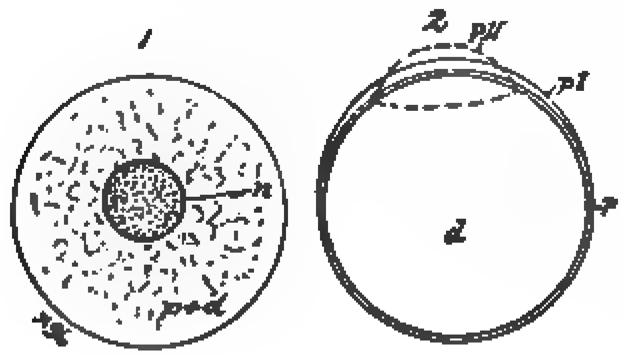
In the eggs of osseous fishes it is certain that the protoplasm, or germinal matter, is arranged on the outside of the yelk, or deutoplasm, in some cases, or sends down processes or a meshwork into the latter, prior to the time of the formation of the germinal disk; so that the teleostean ovum actually passes through a centrolecithal stage. In birds and reptiles, this probably occurs during late intra-ovarian development, as impregnation must occur before encapsulation in the shell, which is formed in the oviduct after the albumen, or 'white,' has been added. Every grade of proportion, from a very small quantity of deutoplasm up to an excessive amount as compared with the germinal protoplasm, may occur; so that no sharp line of demarcation exists between truly holoblastic and truly meroblastic ova. The degree of inequality in the segmentation is therefore, generally speaking, dependent upon the amount of deutoplasm, or food-yelk, which is present, and the degree to which the germinative vesicle has been permanently displaced from its central position. This is, however, qualified by certain secondary modifications, to be discussed at the end of this paper.

This principle accounts for all the forms of unequal segmentation, even including the centrolecithal, where the peripheral segmentation of the germinal matter ultimately displays the working of the same principle of the repulsion of the nuclei from the deutoplasm, and their attraction for the outer protoplasmic segmenting stratum. It, however, explains most beautifully what it is that determines the degree of inequality between the first segmentation-spheres of all truly meroblastic ova. It is therefore of fundamental importance in a scheme of the primary laws of segmentation.

The expulsion of the germinative vesicle from the centre of an evenly segmenting egg, to develop the polar cells, is not to be confounded with the movement of the nucleus towards the periphery of the ovum while still in its follicle, in the large-yelked meroblastic type. The distinction between these two cases, I believe to be fundamental. In the ovum of Ostrea, Unio, Mya, etc., the nucleus at the time of the emission of the egg is still approximately central in position, although the ova are slightly meroblastic; while in Lepidosteus, for example, the nucleus of the nearly mature ovarian ovum is actually peripheral, but has not yet been broken up, or lost its form. Moreover, in the holoblastic type, the nucleus, after its metamorphosis and conversion, in part, into the first segmentation-nucleus, is again repelled towards the centre of the egg, — a phenomenon which does not occur in any meroblastic ovum with a germ-disk of relatively small dimensions, lying upon a disproportionally large yelk. This is a vital distinction, and one which, as far as I am aware, has not been insisted upon in the discussion of nuclear movements. A few illustrative diagrams from the actual subjects will make my meaning much clearer.

Fig. 1 represents an ovicell from the ovary of the common eel, enlarged ninety-six times to show the nucleus (n) in a nearly central position, with a very large number of very small, globular nucleoli adherent to its walls. The surrounding plasma ($p+d$) may be taken to represent both protoplasm and deutoplasm, but in a still undifferentiated state. Fig. 3 is an ovarian ovum of the bony gar (Lepidosteus osseus), very nearly mature, without its granulosa or follicle represented, enlarged seven times. The nucleus (n) in this section has approached the surface of the egg, and is almost or quite in contact with an almost homogeneous outer protoplasmic layer (b) just within the zona radiata (a). Upon examining the material contained within the inner edge of the protoplasmic layer (b), we find that still another differentiation of the egg-substance has occurred by which a portion (p) on either side

of the nucleus (n), and extending around the egg as a thin film, has become quite different from the true deutoplasm (d), which consists of coarse, flattened, ovoidal bodies, as shown in fig. 5 more highly magnified. At the upper pole of the egg, and just below the nucleus (n), the coarser deutoplasm corpuscles or globoids



3 5 4

rapidly become smaller; so that the nucleus is invested by a disk (p) composed of very fine granules, which is in a condition intermediate between that of the external protoplasm layer (b) and the deutoplasm or yelk (d). In very immature ova from the same ovary of Lepidosteus, I find the nucleus in a central position, just as in the ovicell of the eel represented in fig. 1; differing, however, in details of its structure, containing, as it does, a distinct network of trabecular fibres.

The foregoing facts pretty clearly demonstrate the way in which the yelk and germ are differentiated in a meroblastic egg; namely, by a gradual separation of the germinal and deutoplasmic portions of the ovum, the first becoming concentrated peripherally and at one pole by a gradual metamorphosis of the deutoplasm. As this differentiation takes place, it appears that the germinative vesicle is repelled from its original central position, as shown in figs. 1 and 3, and that it never returns to the centre of the deutoplasmic mass, even after the polar cells have been extruded, and the remaining portion has been converted into the nucleus of the first cleavage. In this last regard the meroblastic ovum is in most striking contrast with the holoblastic. Mr. E. L. Mark[1] appreciates this when he remarks, "The nucleus appears ultimately to assume a position of equilibrium, not with respect to the whole mass of the egg, but in respect to its active constituents. Is not, then, this peculiarity ultimately, though indirectly, referable to the want of a uniform distribution of deutoplasm, — to the polar concentration of the protoplasm, in other words?" This covers the ground; but the writer is inclined to believe that the deutoplasm exercises a veritable repulsive force upon the nucleus, as shown in the egg of Lepidosteus, and that in this way only can we explain the failure of the nucleus to return to the centre of the meroblastic ovum after its metamorphosis attending the expulsion of the polar cells, and the fusion of the male and female pronuclei.

The displacement of the nucleus due to its migration during the maturation of the egg has a profound influence upon the mode of development of the various types, as already urged by Haeckel. A study of the mode in which the germ of a fish-ovum is developed may serve to make the nature of this influence clearer. Fig. 2 represents an egg of an osseous fish in diagrammatic outline, without its membrane, in three phases of maturation, up to the time of germ development, which may take place without the influence of the spermatozoon, as shown by the observations of Ransom, Hoffmann, and myself. In the first phase shown by the figure the protoplasm (p) may surround the deutoplasm (d), or it may form a scarcely perceptible layer on the surface of the egg; at a later stage this protoplasm has heaped itself up at one pole of the egg, as shown by the line *pI;* at a still later stage the germinal matter has aggregated itself into a biscuit-shaped germ-mass, the outline of which is shown by the dotted line *p II.* The process is sometimes quite complex, and takes as much as four hours for its completion, as in the cod's egg, in which, as in most fish ova, the disk is formed after the emission of the egg from the ovary. In other types a distinct meshwork of protoplasm, continuous with the external layer, is insinuated between large yelk-masses (d), as shown in fig. 4 at t. This arrangement seems to be the typical one amongst clupeoids. The process of germ-development in true osseous fishes is therefore essentially similar to that which we have described as occurring in Lepidosteus.

According to Hoffmann, the nucleus of the first segmentation is not the one usually hitherto regarded as such, which is concerned in the division of the germ-disk (p) into two equal blastomeres or cells, but its axis in its spindle stage is placed in a line coinciding with

[1] Maturation, fecundation, and segmentation of Limax campestris. — (*Bull. mus. comp. zoöl.*, vi., No. 12, p. 517.)

the axis or diameter of the egg, and not at right angles to it. This is shown in the diagram (fig. 4), in which the first segmentation-nucleus has been metamorphosed into the cleavage spindle (*sp*), with the upper end embedded in the germ-disk (*p*), and the lower end embedded in the protoplasmic layer (*p'*), which consists of the protoplasmic matter not incorporated into the germ, and left over to cover the deutoplasm (*d*). (The thickness of the layer (*p'*) has been exaggerated in the figure for the sake of clearness.) When the spindle (*sp*) has separated equatorially, leaving its upper end in the germ as its nucleus, and its lower end in the protoplasmic layer covering the yelk, as the parent of the free nuclei which afterwards appear in that layer, we may say that the true first segmentation has occurred, which has separated the deutoplasmic or yelk pole of the egg as a single cell from the germ-cell. We see, therefore, that the amount of deutoplasm in excess of the germinal matter actually determines the plane of separation between the germ and the yelk. We can also understand how such an arrangement would cause the mode of development to be modified. The meroblastic and centrolecithal types of ova, on account of the preponderance in bulk of the yelk-mass, are compelled to develop the blastoderm from the disk by spreading, or epibole, or by simultaneous superficial delamination, and cannot be directly transformed into a hollow blastula, as in a holoblastic ovum.

The consequences of the displacement of the nucleus are therefore of great significance in embryology; but the adaptations resulting from the permanent displacement of the nucleus of the ovicell during its development do not end with what has been said in the preceding paragraph. The layer *p'*, of fig. 4, acquires an important physiological function in conjunction with the blood-vascular system, in that it becomes an organ for breaking down and elaborating the yelk into blood-cells in fish ova, as shown by the researches of Vogt, Kupffer, Gensch, Hoffmann, and myself. From the remarkable similarity of the mode of development of the eggs of elasmobranchs, reptiles, and birds, to that of the osseous fishes, — in respect to the mode of germ-formation, spreading of the blastoderm, and the development of free nuclei, in the former and latter types at least, — I should not be surprised if it would be yet determined that such a structure exists in the ova of all of them.

The occurrence of free nuclei, under the blastoderm of the ova of Loligo, Sepia, and Octopus, embedded in the yelk, as found by Lankester; in arthropods by different observers; in those of osseous fishes by Kupffer, Götte, Oellacher, His, Klein, Ziegler, Gensch, Hoffmann, Rauber, and myself; in the ova of sharks by Balfour and Schultz; in those of birds by Götte, Rauber, and Balfour, — is strongly in favor of the doctrine that they have a similar function throughout all of these various forms. Their origin is, doubtless, not spontaneous, as has been believed by some; but, like the nuclei of the blastoderm itself, they have been primarily derived from the first segmentation-nucleus. In Clepsine, according to Whitman, it appears that they enter into the formation of the hypoblast.

Furthermore, it is probable that the development of the germ is actually to be viewed as a process of growth, — concentration of the germinal matter at the animal pole in virtue of its own power of movement. Finally, I would regard the deutoplasm as so much stored material, which — just as the fat globules in a fat cell have pushed the nucleus to the periphery, or as the accumulating fluids in the chorda cells, or as the enlarging sap-cavity in a plant-cell — has displaced the nucleus, and made it assume a parietal position. In evidence of this, I would cite the oval, flattened globoids of the deutoplasm of Lepidosteus (ichthine of Valenciennes and Frémy) as analogous to the stored proteids in many plant-cells. The frequent considerable displacement of the nucleus from the centre of the body in Amoeba, on account of the presence of great numbers of food-vacuoles in the endosarc, seems to be a phenomenon of a similar nature.

The rather anomalous segmentation of the eggs of the frog, lamprey, and Clepsine[1] must be noticed here, as they would appear to form an exception to the principle for which we have contended in truly meroblastic ova; viz., the final dissociation of germinal and deutoplasmic matter at the time of the first cleavage, which divides the whole egg into two nearly equal blastomeres. Immediately or very soon after the first cleavage, the segmentation again becomes unequal, in that smaller blastomeres are formed at the pole where the polar cells have been. or may be supposed to have been, extruded. In this way, it results that a certain mass of cells at the germinal pole of the ovum divide much more rapidly than those containing more deutoplasm at the opposite pole. Now, it is singular that in these types we actually have an approximation towards the develop-

[1] Whitman, Embryology of Clepsine. — (*Quart. journ. micr. sc.*, July, 1878.)

ment of a blastoderm in the more rapid division of the germinal cells at the animal pole of the egg; so that the coarser yelk-cells become included by the blastoderm, by epibole, just as in the typical meroblastic ovum. The segregation of the protoplasmic and deutoplasmic matter, therefore, occurs after the first cleavage in these types; in fact, manifests itself after the first and second cleavages in Clepsine and Rana. It is important to note, however, that in the vicinity where the polar cells have been extruded, the embryonic or germinal differentiation first begins to show itself, and that this is not improbably due to the lingering influence of the original polar displacement of the egg-nucleus at the time of maturation and impregnation. While the germinal vesicle, or rather what represents it, actually returns to the centre of the deutoplasm-laden ovum in these forms, may it not be that a path of germinal matter has remained over in the track of its original outward passage, through which it could return to undergo the first cleavage, shortly after which its segments were again repelled towards the germinal pole?

The mode of evolution of the yelk is of great interest, and doubtless occurred through the working of natural selection. It is evidently adaptive in character; and the necessity for its presence as an appendage of the egg grew out of the exigencies of the struggle for existence. The lower, hollow vegetative cell of a meroblastic egg, such as shown in fig. 4, is, to all intents and purposes, comparable to a fat cell, or to an endosperm cell of a seed containing stored reserve material, which may be, for the most part, in an absolutely non-contractile or static condition, like the oval globoids of the egg of Lepidosteus. JOHN A. RYDER.

BALTIMORE SURFACE-GEOLOGY.

THE 'Geology of the surface-features of the Baltimore area,'[1] by P. R. Uhler, bears evident marks of the author's unfamiliarity with his subject. No proof is offered in support of a number of assertions concerning the age and the physical changes of the Baltimore strata. After mentioning several rocks, which are referred, apparently without any evidence, to the Laurentian and archaean epochs respectively, we are told, that, "during the *Jurassic* period, these archaean upfolds seem to have attained their maximum development." Not a particle of evidence is offered in support of this assertion, which, we think, would need very strong proof indeed; and we are surprised at the facility with which the author handles 'wide-spreading, while comparatively local changes,' for metamorphic purposes. We also fail to see how the abundance of hornblendic and pyroxene rocks is a "restricted element in the structure of the Baltimore rocks, which serves to give them character, and to separate them broadly from members of the series found in other parts of eastern North America." We were not before aware that a prevalence of such rocks was confined to the vicinity of Baltimore.

[1] Johns Hopkins univ. circ., February, 1883.

Leaving the azoic rocks, the author reaches what he calls the Jurassic period, and says that only the upper member of this great age of reptiles, the 'Wealden,' remains within the Baltimore area. The English Wealden is considered by European geologists as the equivalent of the marine Neocomian of the continent, the lowest member of the cretaceous. Moreover, the Wealden is a fresh and brackish water formation, considered to be the local deposit at the mouth of a large river; and, as shown by Mr. Judd,[1] the actual marine representative of the continental Neocomian occurs at the south end of Filey Bay, in Yorkshire. Sir A. C. Ramsay, although describing the Purbeck and Wealden as a special local fresh-water formation, does not hesitate to consider the Wealden as the equivalent of the Neocomian. The preceding facts will show that it is difficult to see why Mr. Uhler uses the term 'Wealden' in connection with the Jurassic period, or why, if the Baltimore strata are the equivalents of the local fresh-water cretaceous deposit of England, he speaks of them as of Jurassic age.

Mr. Uhler, also says that in the upper Jurassic the flora has made a step in advance, gymnosperms taking the place of the old calamites and their relatives. But this step in advance was made already in the triassic keuper, where cycadites and gymnosperms make their appearance. The Wealden flora belongs to that degree of development of the vegetable kingdom which begins with the Rhetic, and ends with the lower cretaceous. This flora does not completely change till we reach the lower Quadersandstein, or upper greensand, where dicotyledons make their appearance; so that, judging on the evidence of flora alone, we should have to place the Gault or lower greensand also in the Jurassic.[2]

At the close of this Wealden (?) period, Mr. Uhler makes the climate colder, and brings great masses of ice to tear things to pieces, but gives no evidence in support even of this assertion.

RAINFALL OF UBERABA, PROVINCE OF MINAS GERAES, BRAZIL.

THE following observations on the rainfall of the city of Uberaba, by Friar Germano, are interesting as being, so far as known, the first that have ever been made in the great interior Paraná basin; those hitherto published being either for the coast-towns and the maritime range of mountains, or, if actually within the interior basins, too near the margin to represent accurately the rainfall of the interior.

Uberaba is situated about 300 miles from the coast, in latitude 19° 44′ 30″ S., on the elevated grassy plains between the Paraná and its great tributary the Rio Grande. Its position as regards the maritime range and the Paraná-Paraguay basin — the South-American homologue of the Mississippi valley — may be compared with that of Cincinnati, or, better, some of the Ohio towns on or near the divide between the Great Lakes and the Ohio River. It is at an elevation of 750 metres above the level of the sea, according to the determination of Friar Germano.

The material is not at hand for an accurate comparison of its rainfall with that of other points where observations have been recorded. It is, however, not

[1] Quart. journ. geol. soc. Lond., xxiv. 218.
[2] Heer, Mondo primitif de la Suisse, pp. 59, 269.

very different from that of Rio de Janeiro (one of the nearest coast-towns where observations have been made) and that of Sabará (some 250 miles to the eastward, near the western margin of the mountainous area of eastern Brazil), and is somewhat greater than that of São Paulo (situated 35 miles from the sea, behind the first ridge of the maritime range).

	1880.		1881		1892.	
	Millim.	Inches.	Millim.	Inches.	Millim.	Inches.
January .	360	14.2	285	11.2	280	11
February .	333	13.1	226	8.9	405	15.9
March . .	109	4.3	138	5.4	180	7.1
April . .	181	7.1	27	1.1	120	4.7
May . . .	19	0.7	15	0.6	60	2.4
June. . .	2	0.1	3	0.1	70	2.8
July . . .	11	0.4	4	0.2	26	1
August . .	2	0.1	6	0.2	80	3.1
September,	70	2.8	12	0.5	97	3.8
October .	190	7.5	102	4	120	4.7
November.	274	10.8	142	5.6	100	3.9
December .	219	8.6	290	11.4	125	4.9
Total . .	1m.770	69.7	1m.250	49.2	1m.663	65.2

NOTE. — In reducing to inches, hundredths have been disregarded.

ORVILLE A. DERBY.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

Pairing of the first-born.

IN SCIENCE of March 16, p. 167, Charles S. Minot estimates the chance of the first-born male pairing with the first-born female, where there are ten birds of each sex to pair, as one to one hundred. It is easy to see that the first-born male must pair with one of the ten females: he is, therefore, as likely to pair with the first-born female as with any other one; and hence the chance that the first-born male will pair with the first-born female is as one to ten, instead of as one to one hundred. J. E. HENDRICKS.

Des Moines, March 27, 1883.

Thermal belts of North Carolina.

The abstract of Prof. J. W. Chickering's paper on the above topic (SCIENCE, p. 147) has suggested to me the propriety of putting on record the results of observations made by me many years ago, on the 'frostless zones' of the flanks of the mountain spurs adjacent to the valleys in the Blue Ridge. My observations were made at Flat Rock, near Hendersonville, Henderson County, N.C.,—a well-watered, fertile, mountain-plateau-like valley, which is about 2,200 feet above the sea-level.

My own observations, and the information elicited from residents, seem to indicate the following facts, which, if verified in other places, may have a bearing on the physical causes which give origin to the 'frostless zones'; viz., the zones in question are *not* exempt from frost during the whole of the cold season: in fact, during the winter, the ground in these belts is frequently frozen to a considerable depth; but during the spring months they are conspicuously and uniformly frostless. They *coincide* with the nocturnal and morning 'fog-belts' of the spring months. The uniform presence of these white, circumscribed belts of fog on the flanks of the mountain spurs, during the early morning hours, imparts a striking feature to the scenery of these valleys. When illuminated by the bright morning sun, they appear like girdles of cotton-wool of moderate width, encircling the peaks at the height of 200 or 300 feet above the adjacent valleys; and their cumulus-like whiteness, contrasted with the verdure above and below them, is no less striking than it is beautiful.

The latter circumstance seems to furnish an explanation of the physical cause of the so-called 'thermal belt;' for the constant fogs at night and in the morning not only prevent refrigeration by obstructing terrestrial radiation, but, during the condensation of vapor in the process of fog-formation, there must be developed an enormous amount of heat just at this zone. Why this condensation of aqueous vapor should be so persistently restricted to a belt of only a few hundred feet in vertical thickness, is a question much more difficult to answer.

The observations of intelligent residents of the mountain valleys, in the southern divisions of the Appalachian chain will doubtless verify or disprove the general *coincidence* of the 'frostless zone' with the 'fog-belt;' and this is the point which some of the readers of SCIENCE may be able to settle.

JOHN LECONTE.

Berkeley, Cal., March 27, 1883.

Flight of the flying-fish.

A note in SCIENCE of March 23, concerning the flight of the flying-fish, leads me to offer the results of my own observations. During a passage through the Indian Ocean in 1880, I had so numerous and excellent opportunities for observing the movements of flying-fish in all kinds of weather, that I determined to discover, if possible, whether or not the wings were of material aid in flight, beyond a mere buoyant action. In many cases the fish would continue its flight for a surprisingly long period, sometimes in the face of the wind. Again, the direction of flight would be changed in such a way as to render it improbable that the wind was the cause. When an object is passing over a rapidly changing surface, it is very easy to imagine it to rise or fall in unison with the latter; but so frequently did I notice a fish clear advancing waves, that I finally was forced to believe them to have the power of controlling their flight. I frequently called upon other passengers to confirm my own observations, with which their testimony was in general harmony. I may say, therefore, that I finally reached the same conclusions as those presented by Mr. Kneeland. D. P. PENHALLOW.

Mountainville, N.Y., March 29, 1883.

THE NATURAL HISTORY OF OHIO.

Report of the geological survey of Ohio. Vol. iv. Zoölogy and botany. Part i. Zoölogy. Published by authority of the legislature of Ohio. Columbus, *State*, 1882. 8 + 1020 p. 8°.

THIS long-looked-for volume has appeared, and, notwithstanding its size, includes only the vertebrates of the state. Dr. Newberry, the head of the survey, holds out some hope of a future volume on the invertebrates and on the botany of the state; but the difficulty experienced in securing further appropriations for the publication of the fossil remains leaves their appearance rather doubtful.

The part devoted to the mammals (a hun-

dred and eighty-five pages), by A. W. Brayton, is largely a compilation, as the author states in his preface; but it contains a considerable number of notes upon the habits of various species, the dates of extinction, etc., which are original and valuable. Keys are given for the families and genera discussed, except in the case of the Muridae and a few other groups. Forty-nine species are enumerated, which are distributed as follows: Carnivora, 15; Ungulata, 3; Cheiroptera, 5; Insectivora, 5; Rodentia, 20; Marsupialia, 1. Of these, the following species are, or are supposed to be, now extinct in Ohio: the puma (Felis concolor), the lynx (Lynx canadensis), the pine marten (Mustela americana), the wolverine (Gulo luscus), the badger (Taxidea americana), the wapiti (Cervus canadensis), the beaver (Castor fiber), and the bison (Bison americana).

The paper may, perhaps, be criticised as not containing sufficient information regarding the distribution of species within the state, nor upon such topics as food, local variation, and similar topics, showing a lack of direct observation upon Ohio specimens.

Dr. Wheaton's welcome report on the birds covers four hundred and forty-two pages. Its introductory chapter treats of the physical geography of Ohio, and some peculiarities of its climate; of latitudinal variation in birds; of the general characteristics and affinities of the class Aves; and of the arrangement and definition of the orders of North-American birds. Most of this matter is compiled from high authorities on the several subjects.

In the main body of the work, also, the technical matter is chiefly taken at second-hand. The keys to the genera are from Dr. Jordan's Manual of the vertebrates of the northern United States; the definitions of the higher groups and the descriptions of species, 'almost without exception or alteration,' from Dr. Coues' Key to North American birds; and the nomenclature from Dr. Coues' Check-list of 1874, 'with such modifications as changes made since its publication require.' The name of each species is followed by 'references to all writers, whether general or local, who have mentioned that species as Ohioan;' and, in addition, the general synonymy of the species is given with sufficient fulness to 'enable changes in the nomenclature to be traced.' There is an appendix, also, which includes a Check-list of Ohio birds, with the dates of their appearance and disappearance, as observed in the vicinity of Columbus; a list of the birds which have been seen in the author's garden, in the heart of that city; a bibliography of Ohio ornithology; an essay on the relation between latitude and the pattern of coloration in Ohio birds; and a glossary of such scientific terms as require definition.

These technical matters have evidently been treated with care, and, in the main, wisely; but it is to the biographical portion of the work that we can accord the highest praise. The biographies are usually from Dr. Wheaton's own pen; and in all such cases they are done in a masterly manner. The author brings to his task an intense inherent love of his subject, a philosophical turn of thought well known to all who are familiar with his writings, and a mind trained to the most conscientious regard for scientific truth and accuracy. In addition, his writings have a literary finish by no means common in these days of hasty production; while the quaintness of occasional expressions, characteristic of a generation fast passing away, adds still further to their charm.

In short, while it would be possible to say ungracious things about this report, we may fairly characterize it, on the whole, as a work of high scientific accuracy, general as well as local utility, and universal interest. It is a pity that the ornithology of every one of the United States cannot be treated in an equally exhaustive and able manner.

The report on the reptiles and amphibians, by Dr. W. H. Smith, already favorably known to herpetologists as the author of a systematic review of the Urodela and Coecilia, occupies more than one hundred pages. Thirty-seven reptiles and twenty-three batrachians are described as native in Ohio, and numerous extra-limital forms are discussed. In general, the report seems worthy of high praise. The technical descriptions are pertinent, and the accounts given of the habits and peculiarities of the different species are full and interesting. Of many of the species mentioned, there is no better account extant. In view of the confused and unsifted condition of the synonymy of American reptiles, the value of the quotations would have been increased by the citation of works as well as authors. We notice a few unexplained, though perhaps justifiable, deviations from current classification; as, for example, the reference of Kennicott's 'Regina Kirtlandi' to Regina rather than to Tropidoclonium. There are also a few unnecessary violations of the law of priority in the nomenclature adopted; as in the retention of the name 'Menobranchus,' instead of the prior and now equally familiar 'Necturus.'

The elaborate report on the fishes, by Professor David S. Jordan, occupying more than two hundred and fifty pages, gives an interesting history of Ohioan ichthyology, with descriptions of all the species as well as of the principal genera and higher groups. It appears that the fauna has been increased from the sixty-six species known to Dr. Kirtland (1840–1846) to a hundred and sixty-five. A useful tabulated synopsis exhibits in four parallel columns the names admitted by Rafinesque, Kirtland, and Günther, as well as Jordan. The fauna is also disintegrated into its several elements, — the Lake fauna (26 sp.), the Ohio-river fauna (37 sp.), and the 'species of general distribution' (28 sp.) 'As an illustration of the character of the local fauna of the smaller streams of the interior,' a list of the species (68) occurring in the White River, near Indianapolis, is added, with notes as to their comparative abundance or rarity.

The typography, although good for a public document, could not be accorded much excellence were the work issued by a private publisher; and the press-work is very unsatisfactory. The synonymy of species is printed in much too large type in the division on the mammals, although afterwards changed. This inequality is unsightly; and numerous typographical errors occur.

GEIKIE'S GEOLOGICAL SKETCHES.

Geological sketches at home and abroad. By ARCHIBALD GEIKIE, LL.D., F.R.S., director of the Geological survey of the United Kingdom. New York, *Macmillan & Co.*, 1882. 370 p. 8°.

IN this pleasant volume, well illustrated by the author's pencil, Prof. A. Geikie has gathered together a number of sketches, essays, and addresses, picturesque, descriptive, and historical, published during the past twenty years in various journals, and all written with some reference to the science of geology, of which he has been so successful a cultivator. Some of these papers have little more than a local and popular interest, but are gracefully written, and well suited to give the unscientific reader a taste for geological studies. Others have a higher significance, and raise questions which are of importance to all students of geology, and would require for their adequate discussion more space than we can here command.

One of the most interesting of these papers is that entitled 'A fragment of primeval Europe,' in which we are introduced to the crystalline rocks of north-western Scotland and the adjacent isles. These ancient gneissic and granitoid strata, first critically studied by MacCulloch, were early recognized as the lithological and mineralogical analogues of the primitive gneisses of Scandinavia and parts of North America; and in 1855, after the name of Laurentian had been given to the latter, it was suggested that the name should be extended to the similar rocks of Scotland, which Murchison had called the fundamental gneiss, — a suggestion since adopted. The aspect of the region occupied by these ancient rocks is peculiar. "The whole landscape is one of smoothed and rounded bosses and ridges of bare rock, which, uniting and then separating, enclose innumerable little tarns. There are no definite lines of hill and valley: the country consists, in fact, of a seemingly inextricable labyrinth of hills and valleys, which, on the whole, do not rise much above, nor sink much below, a general average level." No peaks nor crags are seen; and "the domes and ridges present everywhere a rounded, flowing outline." The whole area is, according to our author, smoothed, polished, and striated, as if ice-worn, and presents, in fact, a typical glaciated surface. Over this 'tumbled sea of gray gneiss' rise conical mountains of nearly horizontal, dark-red sandstone, capped by white quartzites, the summits sometimes attaining 3,400 feet above tide-water. Two good woodcuts serve to illustrate the peculiarities of this curious landscape.

These uncrystalline, unconformable beds of Cambrian age, dipping gently eastward, are succeeded by fossiliferous limestones belonging to the same period, which, in the same direction, appear to pass below a series of flaggy gneisses and crystalline schists, the age of which has been a burning question among British geologists. The problem regarding them is identical with that which has been raised in New-England geology; namely, whether the crystalline schists, towards and beneath which the fossiliferous paleozoic rocks lying to the westward are seen to dip, are newer or older than these. Professor Geikie, for Scotland, holds to the former view, and supposes these crystalline rocks in the Highlands to be formed from a subsequent alteration of still younger paleozoic strata: but in Scotland, as in New England, the opposite view is now, by most geologists, held to be established; namely, that the crystalline rocks in question are pre-Cambrian, and in that sense a part of the 'primeval' world.[1]

Geikie shows that the sculpturing of the

[1] Geological magazine, February, 1883, p. 83.

surface of the Laurentian gneiss of western Scotland was anterior to the deposition of the Cambrian sandstones, and that there are minor domes and bosses of crystalline rock, continuous with those of the exposed surfaces supposed to bear the marks of modern glacial action. The conclusion from this would seem to be, that the latter agency has done little more than groove and polish these ancient rounded surfaces, from which a later erosion had removed the covering sandstone. Whether the pre-Cambrian erosion was glacial is a question which Geikie does no more than suggest. In this connection, the existence of a state of chemical decay as a necessary preliminary to the erosion of crystalline rocks should not be lost sight of.[1] We believe that such a process predetermined the contours of their present eroded surfaces.

The question of the erosion of ancient land-surfaces is further discussed by Geikie in a lecture here republished, given by him before the Royal geographical society in 1879, on The geographical evolution of Europe. In this, by aid of the data of geology, he gives a chapter on what has elsewhere been called paleogeography. Geikie shows that the fragment of primeval Europe already noticed, was a part of a great pre-Cambrian area, to which parts of Finland and Scandinavia belonged, and from which was derived the sediments that built up the Cambrian and Silurian series of Great Britain and western Europe. These lower paleozoic rocks in Great Britain alone, he assumes to cover an extent of 60,000 □ miles, with an average thickness of 16,000 feet, or 3 miles, which figures he considers below the mark, — making not less than 180,000 cubic miles, equal to a mountain range from the North Cape to Marseilles, or 1,800 miles long, 3 miles high, and 33 miles wide. This, he well remarks, represents but a fraction of the material thus derived; since in the seas of that time, extending far eastward, were also laid down great thicknesses of paleozoic rocks, continuous with those of the British isles. Calculations of this kind, applied to North America, give us still larger notions of the erosion of great pre-Cambrian areas belonging to some Palae-Atlantis.

It would be profitable, with Geikie's sketches as our guide, to glance at the glaciers of Norway, the ancient volcanoes of Auvergne and of north-western Europe, and to accompany him, in his excursion in 1880, into our western states, where his quick eye readily comprehended many of those remarkable characteristics which make the transcontinental journey from the Atlantic to the Pacific a geographical education.

In his lecture on assuming his late post of professor of geology at Edinburgh, in 1871, Geikie has happily delineated the characters of the Scottish school of geology, and traced many of the characteristics of its masters — Hutton, Playfair, and Sir James Hall — to the local peculiarities of their native land, with its crystalline, contorted, and unfossiliferous rocks, so unlike the regions in which the early Italian school laid the foundations of geology. It is instructive, in this connection, to reflect how the great and simple outlines of American paleozoic stratigraphy, as displayed in the Appalachian basin, led to the grand conceptions of structural geology formulated by the brothers Rogers, by James Hall, and by Lesley, and how the remarkable features of our western regions have taught our geologists of the younger generation lessons which have enabled them so greatly to advance the science, and to correct the views of their predecessors, both in the old and the new world.

We hope on another occasion to notice more in detail some of the questions raised in this instructive volume, in which every student of geology will find something to instruct him, and to stimulate thought.

[1] Harper's annual record of science, etc., 1873, p. xlix.

VERTEBRATE ANATOMY.

A handbook of vertebrate dissection. Part ii. How to dissect a bird. By Prof. H. Newell Martin and Dr. William A. Moale. New York, *Macmillan*, 1883. 4 + [86] p., 3 pl. 12°.

This second part of the handbook is quite up to the standard of the first. It is comprehensive, without going beyond its intended limits; the descriptions are clear and well-worded; the subjects selected for illustration are those most needing it, viz., the more complex parts of the skeleton; and the diagram constituting figure 5 will prove very useful in clarifying certain ideas of the learner.

The method of treatment is well calculated to bring out the observational power of the student; and the fact that the avian, rather than the generic and specific characters, are made prominent, renders the book much more widely useful, and also serves to commend it to practical workers in zoölogy. With the other books of this series, which are to treat in a similar manner of a rat, a bony and cartilaginous fish, and one of the large, tailed amphibia, or Urodela, we shall be supplied with a book which has long been needed in America.

It will be especially welcomed in those laboratories where considerable attention is already given to vertebrate work; and it will do good service in aiding to bring about a more equitable division of time and opportunities in those laboratories where the invertebrates have hitherto received the lion's share of attention, and in some cases have taken nearly, or quite all, the time in a course supposed to be devoted to general zoölogy.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Attractions. — M. Angelitti discusses the case of the attraction exerted between two masses when the attraction varies as the product of the masses and some function of the distance. The particular function of the distance employed is the inverse nth power. The author considers the attraction of lines and plane figures upon a point in the plane, and finally briefly considers the attraction of surfaces and solids upon points external to them. Nearly all of the results are known, many of them having been given by Jellett and Townsend. — (*Giorn. mat.*, xx.) T. C. [584

Bernouilli's numbers. — Mr. Ely, in a paper read before the J. H. U. mathematical society, Jan. 17, 1883, gave an account of the numbers $A_{n,m}$ (generally known as $\Delta^n O^m$) which occur in the proof of Staudt's theorem concerning Bernouilli's numbers. After giving the definition of these numbers in the form of a series, and stating some of their known properties, Mr. Ely proceeds to enunciate a number of new properties. Without using a great many algebraical symbols, it is impossible to give a fuller notice of Mr. Ely's interesting communication. — (*Johns Hopkins univ. circ.*, No. 21, 1883.) T. C. [585

Partitions. — Professor Sylvester defines partitiongraphs, and makes certain applications of their properties to infinite series and infinite products, and particularly to the two forms of representation of the theta functions of one variable by means of an infinite series and an infinite product. A partitiongraph is defined as a series of points lying in lines parallel to two fixed lines. The number of points, or lines parallel to one of the boundaries chosen at will, will represent the successive components of the partition, and the number of the lines themselves will be the number of parts in the partition. The lines in question are termed *magnitude*-lines, and the crossing ones *part*-lines. The graph is termed regular when the magnitude-lines never increase as they recede from the rectilinear boundary to which they are parallel. This cannot happen without the same being true of lines parallel to the part-boundary. A regular graph is thus one in which the lines and columns of points neither of them increase as they recede from their respective boundaries. A partition is self-conjugate when its representative graph, after an interchange of the names of the part- and magnitude-lines, gives the same reading. Such a graph is therefore symmetrical. By application of the properties of the above-described partitiongraphs, Prof. Sylvester proves the equation between the reciprocal of $(1-ax)(1-ax^2)(1-ax^3)\ldots$ and the infinite series

$$1+\frac{x}{1-x}\cdot\frac{a}{1-ax}+\frac{x^4}{(1-x)(1-x^2)}\cdot\frac{a^2}{(1-ax)(1-ax^2)}+\cdots$$

He also shows how to obtain the development in infinite series of the infinite products $(1+ax)(1+ax^3)(1+ax^5)\ldots$ and $(1+a^{-1}x)(1+a^{-1}x^3)(1+a^{-1}x^5)\ldots$ A parallel bipartition of u is defined as a couple of sets of numbers written on opposite sides of a line of demarcation, so that the number of numbers on the left always exceeds that on the right by a given difference, δ, which may be any number from zero upwards, and such that the sum of all the elements collectively is equal to n. Then the co-efficient of $x^n a^j$ or $x^n a^{-j}$ in the above products is the number of parallel bipartitions of n to the difference j, limited to contain only odd numbers, which must not appear in the same arrangement more than once on the same side of the line of demarcation. In vol. v., No. 3, of the *American journal of mathematics*, Prof. Sylvester will give a full account of this new theory of partitiongraphs. — (*Johns Hopk. univ. circ.*, No. 21.) T. C. [586

PHYSICS.

(*Photography.*)

Speed of drop-shutters. — M. Vidal has suggested a method of measuring short exposures. He employs a large clock-face painted black, with white figures, numbering from 1 to 100, painted upon it. A white index-hand is revolved from behind at a uniform speed of one turn per second. Photographs taken of this apparatus themselves register the time of exposure. — (*Brit. journ. phot.*, March 9.) W. H. P. [587

Photographic defects and their remedies. — A short article by Mr. E. H. Farmer gives a list of all the principal photographic defects, together with their remedies. They include gray or metallic, pink, green, yellow, red, and white or opalescent fogs; also frilling, halos, want of density, and spots on the film. — (*Brit. journ. phot.*, March 9.) W. H. P. [588

Notes. — To make plates tropical. Heat them for two hours in a hot oven.

To clean plates. Soak them in hot water, which will dissolve the gelatine.

A convenient plate-lifter. Solder a long, pointed piece of metal to an ordinary thimble. By this means, the plates can readily be lifted from the trays. — (*Phot. times*, Feb.) W. H. P. [589

Electricity.

Efficiency of an electric motor. — Professor S. P. Thompson shows very simply, by means of a graphical method, the laws of work and efficiency of an electromotor, as dependent upon the ratio of its electromotive force to that of the electric supply. — (*Phil. mag.*, Feb.) E. H. H. [590

The electrostatic and electromagnetic systems. — The French have been taking their turn in discussing this matter. MM. Mercadier and Vaschy seek to reconcile the two systems by means of coefficients depending on dielectric and magnetic inductive capacities. Their arguments and experiments are criticised by M. Maurice Lévy. One who has followed the discussion of this matter, as it has appeared in the *Philosophical magazine* during the

past year, and has read in particular the article of Dr. O. J. Lodge in the November number, will probably learn but little from the French treatment of the subject. — (*Comptes rendus*, Jan. 8, 22. 29, and Feb. 12.) E. H. H. [591

A new dynamometer. — Dr. H. Hertz calls attention to the fact, that, in a Weber's dynamometer, the ratio of the apparent resistance offered to an alternating current of period (T) to the real resistance (r) of the instrument is $\sqrt{1+\left(\frac{P^2\pi^2}{T^2r^2}\right)}$, where P is the co-efficient of self-induction. He concludes that the instrument can give no information as to the presence or absence of a current which changes its direction more than ten thousand times in a second; nor can it be applied to such problems as the discharge of a Leyden jar through a short metal conductor. He therefore proposes a new dynamometer, which measures the energy by the heating of a small silver wire through which the current passes. The expansion of the wire is made to rotate a steel needle to which a mirror is attached. It is claimed that a change in temperature of a thirtieth of a degree, cent., can thus be detected. The self-induction of this instrument is, of course, zero; and its resistance need not be large. From experiments on an instrument of resistance .85 S. U., the author concludes that a current of one Daniell's cell through 30 S. U., and, by shunting, currents of any strength, may be determined with sufficient accuracy. — (*Zeitschr. f. instrumentenkunde*, Jan.) J. T. [592

CHEMISTRY.

(*Organic.*)

Kyanethine and certain of its derivatives. — In continuing the study of kyanethine, E. v. Meyer finds that nitrogen is eliminated by the action of nitrous acid with the formation of an oxy-base, $C_9H_{13}N_2(OH)$ (oxykyanconiine). Methyl iodide forms methylkyanconiine, $C_9H_{13}N_2(NHCH_3)$, in which the methyl group is attached to a nitrogen atom, as shown by the formation of methylamine and the oxy-base, when it is heated with hydrochloric acid. Methyl-, ethyl-, and ethylen-derivatives of the oxy-base were examined. By the action of bromine upon kyanethine, an oily product was obtained, which gave a fat acid (probably propionic), isodipic acid $\left(\begin{array}{l}CH\ CH_3\ COOH\\ |\\ CH\ CH_3\ COOH\end{array}\right)$, and a third acid containing nitrogen. When mixed with two volumes of concentrated ammonia, the chief product was an amide of the same butylendicarboxylic acid. The formula

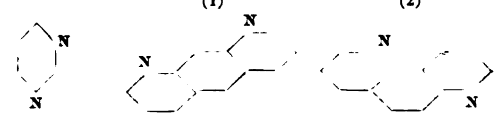
$$\begin{array}{l}\quad(CH_3)_3\\ C_6H_5-N=NH\\ \qquad\diagdown\\ \qquad NH_2\end{array}$$

is regarded by the author as the most probable expression of the constitution of kyanethine. Kyanmethine was also prepared by the same method; viz., by the action of sodium upon methyl cyanide. Its derivatives and reactions were analogous to those of kyanethine. — (*Journ. prakt. chem.*, xxvi. 337, and xxvii. 152.) C. F. M. [593

Meconic acid and its derivatives. — That meconic acid is not a tribasic acid, as Liebig and others have asserted, is shown by a study of its ethers. E. Mennel prepared the mono- and diethyl-ethers with alcohol and hydrochloric acid; but the triethyl ether could not be obtained in this way. The third ethyl group was introduced by heating the silver salt of the diethyl ether with ethyl iodide. The absence of other hydroxyl groups was shown by ferri cchloride, which gave no red color when added to an alcoholic solution of the ether. Mennel assigns to this acid the formula $C_5HO_2\overset{COOH}{\underset{OH}{COOH}}$. If it has this constitution, the ethyl group attached to the hydroxyl must have different properties from either of the two attached to the carboxyl groups. That this is the case, appears from the formation of ethylmeconic acid when the triethyl ether is heated with water, and from the conversion of ethylmeconic, when heated, into ethylkomenic acid, $C_5HO_2\overset{COOH}{\underset{OC_2H_5}{COOH}} = C_5H_2O_2\overset{COOH}{OC_2H_5}$. Bromoxylbromkomenic acid $\left(C_5HBrO_2\overset{COOH}{OBr}\right)$ was prepared by acting upon bromkomenic acid with bromine and water. With reducing-agents, it gave bromkomenic acid, which was converted into oxykomenic when heated with hydrochloric acid in an alcoholic solution. It seems that the hydrogen atom in the radical of meconic acid $(C_5HO_2)'''$ can be substituted only with difficulty, and but one hydrogen atom in the komenic-acid radical $(C_5H_2O_2)''$ can be replaced. — (*Journ. prakt. chem.*, xxvi. 449.) C. F. M. [594

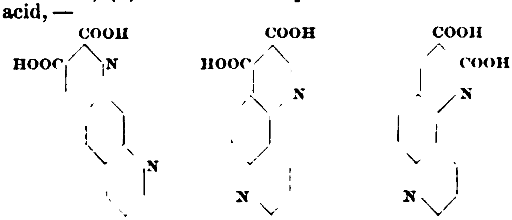
Derivatives of dipyridyl. — By means of the glycerine-chinoline reaction, Skraup and Vortmann obtained from metadiamido- and metadinitro-benzol phenanthroline $(C_{12}H_8N_2)$, which contains two pyridine rings, —

(1) (2)



Diamidobenzol. Phenanthroline.

Although but one pyridine ring takes part in reactions with methyl iodide, bromine and acids, an octo-hydride $(C_{12}H_8N_2H_8)$ resulted from the action of nascent hydrogen. By oxidation with potassium permanganate, beside chinolinic acid, dipyridyldicarboxylic acid was formed in small quantity. One carboxyl group was removed from this acid by heat alone; and, on heating with calcium hydrate, an oil (dipyridyl) distilled over. According to the authors, this is the first representative in the pyridine series of bodies analogous to diphenyl. If phenanthroline is an analogue of anthracen, (1) there would be but one form for the dicarboxylic acid; but if, as the authors regard more probable, it is similar to phenanthren, (2) there are two possible forms for this acid, —



— (*Sitzungsberichte kais. akad. Wien.*, lxxxvi. 304.) C. F. M. [595

On acetoxime. — A study of the benzyl-derivatives of acetoxime indicates the formula

$$(CH_3)_2 = C = N - OH.$$

This substance was obtained by v. Meyer and A.

Janny from acetone and hydroxylamine. From the formation of benzyl iodide when its benzyl ether was treated with hydriodic acid, the benzyl group must be attached to the rest of the molecule by the oxygen atom. — (*Berichte deutsch. chem. gesellsch.*, xvi. 170.) C. F. M. [596

Acetoximic acids. — C. Schramm obtained representatives of this class of bodies by the action of hydroxylamine chloride on isonitrosoethyl- and isonitrosobenzyl-acetone. In general, the reaction may be expressed by the equation

$$\begin{array}{l} \chi - CO \\ \quad | \\ \gamma - CNOH \end{array} + H_2NOH - HCl = \begin{array}{l} \chi - C = NOH \\ \quad | \\ \gamma - C = NOH \end{array} + H_2O + HCl.$$

— (*Berichte deutsch. chem. gesellsch.*, xvi. 180.) C. F. M. [597

METALLURGY.

Mexican copper-smelting. — A native process of working copper ores is described by W. B. Devereux, as now being practised in the state of Jalisco, Mexico, and as producing very pure copper by using two tons of charcoal to one ton of ore. A basin eighteen inches in diameter, and three inches deep in the centre, is made in the earth, and lined with oak-ashes. Upon one side of the basin two tuyeres are placed, which are blown by a hand-bellows. A log is placed with one end across the basin at right angles with the tuyeres, and is supported on a roller, so that it can be fed up as fast as it is consumed. The charcoal and calcined ore are placed on the side of the log opposite to the tuyeres, and are renewed as fast as they are burned and melted away. Three hundred pounds of ore are said to be smelted in four hours. The copper and cinder settle into the basin; and, when the latter is full, the charcoal is scraped away. The slag, as it cools on the surface, is lifted off in cakes until the copper is exposed. This is allowed to cool. The cake of copper is then removed, and the operation begins again. The copper is so pure that it can be rolled without cracking. The whole smelting process is performed without the aid of a single tool that cannot be obtained in the chase, in the woods, or in the clay-bank. The calcining of the ore is done in an English calciner, left on the location by a former company. — (*Trans. Amer. inst. min. eng.; Col. meeting*, 1882.) R. H. R. [598

The patio process in San Dinas, Mex. — As described by Richard E. Chism, the broken silver ore is ground in an arrastre till there is no more grit. It is then brought to the patio, or large, circular, concave, paved floor. Here it is treated at intervals with mercury, salt, and sulphate of copper, and is stirred and worked by the feet of mules. It is then exposed to the sun for some days. Finally, the amalgam formed is washed and retorted. The cheapness of the plant is its great recommendation. This paper is a carefully written description (giving figures) of the process as it is at present used. — (*Trans. Amer. inst. min. eng.; Col. meeting*, 1882.) R. H. R. [599

Charcoal-making in retorts. — In a paper on charcoal as a fuel in metallurgy, John Birkinbine states, that at the Bangor furnace, Mich., there are fourteen kilns of eighty cords capacity, in which sixteen thousand cords of wood are annually carbonized. At the Elk Rapids furnace, Mich., there are twenty-two one-hundred-cord kilns, in which forty thousand cords of wood are each year converted into charcoal. The acetic vapors are exhausted from all these kilns by Peirce's patent method, and converted into acetate of lime and methylic alcohol. The two plants produce daily seventeen thousand pounds of acetate of lime, and two hundred and fifty gallons of alcohol. That the charcoal is not deteriorated by the collection of the acetic vapors, is proven by the reports of the managers of these plants, and by the remarkable records made by both these furnaces. — (*Trans. Amer. inst. min. eng.; Col. meeting*, 1882.) [600

AGRICULTURE.

Artificial and natural digestion of proteine. — Stutzer, having devised a method for the separation of the true proteine of fodders from the non-proteid nitrogenous matters, has applied this method to the study of the action of acidified pepsin solution on the proteine of feeding-stuffs. As the general result of his experiments, he finds that the nitrogenous matters of fodders may be divided into two groups, called by him proteine and nucleine; the former of which is entirely digestible, and the latter entirely indigestible. Stutzer's results on certain feeding-stuffs agreed quite closely with those that have been obtained in actual digestion experiments with animals, and suggested the possibility of thus artificially determining the digestibility of this important class of nutrients in a very simple manner; but no comparative experiments on identical samples were made.

This deficiency has been supplied by Pfeiffer, who has compared the actual digestibility of meadow-hay and lucerne-hay, by sheep, with the results obtained by Stutzer's method. The results of three experiments are given. In each case the actual digestibility was somewhat less than that indicated by Stutzer's method.

Calculated digestibility.	Observed digestibility.
68.4 per cent.	60.4 per cent.
76.1 "	73.0 "
76.1 "	74.5 "

A portion of the nitrogenous matter of the solid excrements, however, consists of billiary products, and other matters not derived directly from the food, and therefore not properly classed with its indigestible matters. When this was taken into account in calculating the actual digestibility, a closer agreement was obtained than is shown by the above figures.

On the other hand, however, the nucleine of the solid excrements, as determined by Stutzer's method, was twenty-five to thirty per cent less than the amount found in the fodder, showing that some of the latter must have been digested. It would seem, then, so far as conclusions can be drawn from three experiments, that Stutzer's proposed method may serve to give an approximation to the digestibility of the proteine of a fodder, and possibly prove a useful addition to the methods of fodder analysis, but that his artificial digestion does not correspond in all respects with natural digestion. — (*Biedermann's centr.-blatt*, 1882, 739.) H. P. A. [601

Digestive fluids of the horse. — Space permits only a summary of the more important results obtained in this valuable investigation by Ellenberger and Hofmeister.

a. The saliva. The mixed saliva contains an energetic diastatic ferment, which acts at once on cooked starch, but more slowly on uncooked. Potato-starch is not saccharified during mastication, but minute quantities of oat or barley starch may be. Both the parotid and the submaxillary saliva have a diastatic action, though it is not so energetic as that of the mixed saliva. The action of the mixed saliva equals 'the product of the actions of its components.' In

the blood of the horse, and also in most other fluids and organs, diastatic ferments are present, but in much less quantity than in the saliva. Slightly acidifying the saliva, or mixing it with small quantities of artificial (acid) gastric juice, does not hinder the diastatic action. Greater concentration of the acid hinders the action, but does not destroy the ferment. The saliva acts slowly upon cane-sugar. The parotid saliva contains traces of a peptonizing ferment. The saliva does not act upon cellulose. It can emulsify the fats, but does not decompose them.

b. The gastric juice, and gastric digestion. The gastric digestion of the horse is of more importance than has been hitherto supposed. It continues from one meal to the next. When oats are fed, the contents of the stomach constitute a comparatively dry, crumbly mass, containing sixty to seventy per cent of water. With hay-feeding, the contents are somewhat moister. The normal reaction of the contents of the stomach is distinctly acid. The proportion of acid seldom rises higher than two-tenths of one per cent. It is least immediately after eating, and increases gradually. The gastric juice of the horse is much less acid than that of the carnivora. At the beginning of digestion, only lactic acid is present. Subsequently, hydrochloric acid appears, and more abundantly with hay-feeding than with oats; but lactic acid is always present. In the contents of the stomach there is always found a diastatic, a lactic, and a rennet ferment, and a ferment which dissolves proteine. Starch is digested to a large extent in the horse's stomach: the action is most rapid during the first one or two hours, though depending somewhat on the quantity and quality of the food. Vegetable proteine is energetically digested, and converted into peptones. The action is slight at first, but augments, reaching its completion in three to eight hours, according to the amount of food present. When large amounts of food are taken into the stomach, much pepsin and acid must be secreted to neutralize the alkaline saliva, and initiate digestion; and, consequently, the time required for digestion is longer. If more food is taken in such a case, that previously eaten is crowded into the intestines in an undigested state. — (*Biedermann's centr.-blatt*, 1882, 805.) H. P. A. [602

GEOLOGY.

Atlantis revived. — Professor Hull has published twenty-seven "Paleo-geological and geographical maps of the British Islands and the adjoining parts of the continent of Europe," showing the distribution of the exposed strata of the different geological periods, and their concealed extension. In portraying the latter he has been largely aided by the numerous borings which have been made during the last twenty-five years. Some of the maps show the known and theoretical distribution of land and water during the different geological periods.

In preparing these maps, Prof. Hull has become forcibly impressed with two leading ideas, — first, that the present North Atlantic Ocean must for a long lapse of time have been a continental area, whence was derived, to a large extent, the sediment of which many of the British formations are composed; and, secondly, that the Old Highland districts of the British Isles, once they had sprung into existence as such, ever after endeavored to retain their ascendency. He considers "that the North Atlantic was mainly land during the Laurentian, Cambrian, and lower Silurian periods, and was the source of the sediment of which these great formations are composed. It probably first assumed large proportions as a sea or ocean, when so much of the *then sea* became land; namely, at the close of the lower Silurian period. But there are grounds for believing that it was largely in the condition of a land-surface in still later times; namely, during the carboniferous, Permian (dyassic), triassic, and Jurassic periods, as evinced by the thickening of the sediment both towards the north-west and south-west of the British Isles. This great continent of *Atlantis* was the parent of much of the strata which now overspreads the plains of Britain and of the adjoining continental areas. With the cretaceous period, its permanently oceanic form and features set in, and were vastly extended during that and the succeeding period of the nummulitic limestone." A description of each plate is given, which is clear and systematic, containing many references to different authorities used. A discussion of each map would require a memoir as large as the original: suffice it to say, that the work has been prepared with care, and reflects great credit on its author. There are many points in the geology of North America which would appear to be strongly in favor of Mr. Hull's views; such as the Jurassic age of the Rocky-mountain uplift, and the absence in the same region of any Silurian strata, the carboniferous limestone reposing on the Taconic or on older rocks, showing that region to have been land during the formation of the vast Silurian sediments of the Mississippi basin; the absence of more recent formations on the north-eastern coast; the fresh-water nature of the Richmond trias, etc. Prof. Hull has done well in attacking the theory of the permanence of ocean-beds, which, in my opinion, is not borne out by the geological facts; and a perusal of his work should encourage others to enter into this very interesting field of research. — (*Trans. roy. Dubl. soc.* (2) i. xix.) J. B. M. [603

Meteorites.

The Cranbourne meteoric iron. — Two large blocks of meteoric iron were found in Victoria, Australia, in 1854; one mass weighing several hundredweight, and the other three or four tons. This last was sent to the British museum, and has recently been studied quite thoroughly from the chemico-mineralogical point of view by Dr. Walter Flight, of that museum.

When this mass was found, only a small portion projected above the soil, while the remaining portion was embedded in tertiary sandstone overlying basalt. Dr. Flight states that the entire mass consists of metallic minerals, and is destitute of silicates. In the course of the analysis, the nickeliferous iron was found to contain numerous minute, brittle, strongly magnetic, apparently square prisms, which form about one per cent of the mass. These prisms are slowly and with difficulty acted upon by HCl, but are readily dissolved in HNO_3. To this, after analysis, the symbol $(Fe_4Ni_3)P$ was given, and it was regarded as corresponding to Gustav Rose's rhabdite.

Certain scales were observed lying on the faces and between the plates of the nickeliferous iron crystals, that were in the form of equilateral triangles, having the thickness of stout writing-paper, pliant, strongly magnetic, and of a pure white color. It was found to contain 70.138% iron, and 29.744% nickel, and was regarded as being the same as Gustav Rose's tänite, and Zimmerman's meteorine. Since the composition was first definitely made out by Dr. Flight, he proposes for it the name *edmondsonite*. It would certainly have been a more gracious thing if he had allowed Rose's name to stand, instead of yielding to the species-making mania, and thereby increasing the confusion in mineralogical nomenclature.

The analysis of a brittle, magnetic powder, which

dissolved easily in HNO_3, and which was regarded as schreibereite, gave the formula $(Fe_2Ni)_7P$. A large brass-colored, oblique crystal, showing perfect basal cleavage, dissolved readily in *aqua regia*, but was only slowly acted upon by HCl or by HNO_3 alone, and gave, on analysis, the formula $(Fe_9Ni_2)P_2$. Another crystal was found, which was apparently a square prism, having brilliant metallic sides, with a dark, almost black centre. Its analysis gave the formula $(Fe_7Ni_2)_8P$. Graphite occurs occasionally in this meteorite, both in nodules and in plates. The nickeliferous iron was also examined for occluded gases; and carbonic acid, carbonic oxide, hydrogen, nitrogen, and marsh gases, amounting in bulk to 3.59 times the volume of the iron, was extracted.

It is to be regretted that more attention is not paid by chemists to the question of the average composition of meteoric masses as a whole, instead of giving their time exclusively to the analysis of the distinct minerals the mass may happen to contain. — (*Geol. mag.*, Feb., 1883.) M. E. W. [604

METEOROLOGY.

Canadian weather-review for February, 1883. — This review has been issued very promptly. It consists of a compilation of items of interest relating to storms, temperature, precipitation, etc., for Canada. The mean temperature was much below the normal, especially in the maritime provinces. At Sydney, C.B., the defect was 7.1°. A very important table is presented, showing the total number of hours of sunshine at thirteen stations of the dominion. Since the well-being of crops is dependent, in large measure, on the amount of sunshine, such records, it would seem, would be of great value. The service finds 71.2 per cent of its probabilities fully verified. Full record is given of the special disturbances of the magnetic needles at Toronto. These show very markedly the intimate relation between the aurora and magnetism, as has been known for many years. Auroras were seen on the 1st, 4th, 22d, and 27th. — H. A. H. [605

State weather-services. — The Ohio weather-service has issued its report for January. This shows an addition of six stations since the November report, there being twenty-five in all at the present time. Thirteen of the stations have barometers. The observations, day by day, are published in full, and will form a more satisfactory basis for more detailed study than can be had from stations at greater intervals.

The Tennessee weather-service has issued its first monthly report for February. This shows that twenty-two stations are now observing the weather, and twenty-eight more are soon to join in the work. It is to be hoped that these stations of observation will not only add to our store of knowledge, but also increase interest in a large mass of people to whom an accurate forecast of the weather is of great consequence. The observation of rainfall, for example, is one of the simplest that can be made, and, all along the watersheds of our rivers, would assist very materially in the discussion of floods, droughts, etc. — H. A. H. [606

GEOGRAPHY.

Reviews. — 'Japans landwirtschaftliche und allgemeinwirtschaftliche verhältnisse,' by Georg Liebscher (Jena, 1882), is reviewed by Alf. Kirchhoff in *Ausland*, 1882, 881-887.

The geographic observations in Nordenskiöld's 'Umsegelung Asiens und Europas auf der Vega' (Leipzig, 1882) are summarized in *Ausland*, 1882, 947-954.

'In fernen osten; reisen des grafen Szechenyi in den jahren 1877-1880,' by G. Kreitner (Vienna, 1881), is reviewed by A. H. Keane in *Nature*, Dec. 21, 1882.

Elwes' translation of Capello, and Ivens' narrative, 'From Benguela to the territory of Yacca' (London, 1822), is noticed by E. C. Rye in *Proc. roy. geogr. soc.*, iv. 701. — W. M. D. [607

(*Africa.*)

Wissmann's letter from Cairo. — Under date of Jan. 5, Wissmann wrote to the German-African association from Cairo, where he was detained by sickness that began on his homeward voyage up the Red Sea. The following abstract notes his more important statements, but his route is difficult to follow from lack of his names on even the most recent maps. Early in December, 1881, Wissmann left Kingenge, with Pogge and a caravan of two hundred men, and, on passing the Lulua, reached the limit of the west African wooded savannahs, and entered the thickly populated prairies of central Africa. Lake Mukamba was reached in the middle of December, in lat. 5° 45′ S., concerning which further details will be given. Passing the populous district of the Bashilange, the explorers came to the Lubi on Jan. 5, 1882, and entered the country of the Bassonge (sing., Mussonge), — a fine, strong, industrious race, living in neat villages, with houses surrounded by gardens, and separated by straight streets shaded by palms and bananas. They work in iron, copper, clay, and wood, and understand weaving and basket-making. Two days' march through forests inhabited by elephants and buffaloes led them to the residence of the king, Katjitch, on the Lubilash (Sankuru), lat. 5° 7′ S., where they rested a week. On starting again, there was some difficulty at first in obtaining permission to go; for the king wished them to stay and help him against an attack from the Bakuba on the north. Leaving the Lubilash on Jan. 29, they crossed a fertile, well-watered region, occupied by warlike Bassonge, by long villages of Benecki (sing., Munecki), and by the timid Kalebue, nearly all of whom are cannibals, and, on March 8, came to the Lomami, lat. 5° 42′. From here to Tanganyika were found the Batua (Stanley's Watwa), who seem to be the remaining tribes of the early people of this region. They live in miserable huts, without industry or agriculture, and subsist on wild fruits and by hunting. On April 17, the party arrived at Nyangwe on the Lualaba, lat. 4° 13′ S., and were well received and aided by the Arabs of that half-civilized town. There the explorers parted. Pogge turned back on May 5; and, after some delay, Wissmann started eastward with a small party on June 1, having much trouble with his men and the people, on the way, till he reached the great lake. There, at Ruanda, he enjoyed the hospitality of the English missionary, Griffith, and made a four days' excursion to the Lukuga, concerning which he promises interesting information as to the part it plays as Tanganyika's outlet. Crossing to Udjidji, the rest of his way led through less unknown country. His most important *détour* was to 'Uhha' (Udjowa?), where King Mirambo received him in the most friendly manner, with roast beef and champagne. On Sept. 5 Wissmann was welcomed to Tabora by the French missionaries there, and shortly afterwards reached the German station in Gonda, where he found Böhm and Reichardt about to start on an extended journey farther inland, Kaiser having already set out. On Nov. 15 he arrived safely on the eastern coast. — (*Ausland*, 1883, 134; *Comptes rendus soc. géogr. Paris*, 1883, 90.) W. M. D. [608

Rio Bembe. — D. T. das Neves prefaces an account of his exploration of this river, generally given as the

Limpopo on the maps, with an historical sketch of the native government of the region, of which Muzila, son of Manicussa, is at present the head. After the Zambezi, the Bembe is the largest river of eastern Africa. Its valley is very fertile, — suitable for the growth of sugar-cane, cotton, etc., — and is well populated. To the northward the country is more healthy for Europeans. Its fine forests of valuable wood contain many elephants, and its saline lagoons are full of hippopotamus; but, "in consequence of the absence of native population, the tsetse-fly is found everywhere through it." In a somewhat exalted peroration, the author concludes with, "We have traversed a vast area of the province of Mocambique, finding it all most salubrious and excellent for occupation by the white race. It possesses all the conditions to make it suitable for the immigration of millions of Europeans, who will find its soil more fertile than that they have left. It is perhaps the most populous region of all tropical Africa; and its millions of natives, placed in contact with civilization, will become consumers of innumerable European wares." — (*Bol. soc. geogr. Lisboa*, 1882, 336.) W. M. D. [609

BOTANY.

Ice-plant (Mesembryanthemum crystallinum). — M. Herve Mangon calls attention to the ease with which this plant can be cultivated on a large scale as a source of potash. According to him, the fresh plant contains about half of one per cent of potash. — (*Comptes rendus*, Jan. 8, 1883.) G. L. G. [610

Loss and gain of nitrogen by arable soil. — M. Dehérain gives a very interesting account of his experiments at the station at Grignon, which may be summarized as follows: the loss of combined nitrogen which a harvested field sustains is not due exclusively to the removal of the crop, but is largely attributable to the oxidation of nitrogenous matter in the soil, and its escape in the form of nitrates in drainage-water. The loss is greatest when the use of fertilizers has been most generous, and it ceases when the fields lie fallow. The reason for the latter is, that then the air penetrates less deeply. The results are quite in accord with those previously reached at Rothamsted. — (*Comptes rendus*, Jan. 15.) G. L. G. [611

Solar radiation, and assimilative activity. — Timiriazeff, whose experiments upon the action of chlorophyll are of great importance, has lately published in a short note a few of his more recent results. Quantitatively determined, forty per cent of the amount of solar energy absorbed by a green leaf under the most favorable conditions is converted into chemical work. He calls attention to the usefulness of Langley's bolometer in such investigations. — (*Comptes rendus*, Feb. 5.) G. L. G. [612

The difference between the chemical constitution of living and dead protoplasm has been further studied by Loew; and the results of the investigation, too complicated for a short abstract here, accord in the main with those previously noticed in this journal. — (*Pflüger's archiv*, Feb. 12.) G. L. G. [613

Fertilization of Yucca. — The deliberate pollination of Yucca-flowers by a tortricid moth (Pronuba), to insure the production of seed for its young to feed upon, is will known through the publications of its discoverer, Prof. Riley. From an abstract of a paper read last summer at the Montreal meeting of the American association, by the same observer, it appears that the act of collecting pollen by Pronuba for the fertilization of the Yucca "is as deliberate and wonderful as that of pollination. Going to the top of the stamen, she stretches her tentacles to the utmost on the opposite side of the anther, presses the head down upon the pollen, and scrapes it together by a horizontal motion of her maxillae. The head is then raised, and the front-legs are used to shape the grains into a pellet, the tentacles coiling and uncoiling meanwhile. She thus goes from one anther to another until she has a sufficiency." The conclusion of Dr. Engelmann, that the apices of Yucca stigmas are not receptive, is confirmed. "The exceptional self-fertilization in Yucca aloifolia, the only species in which it is recorded, is shown to be due to the fact, that, in the fruit of this species, there is no style, the stigma being sessile, and the nectar abundant, filling and even bulging out of the shallow opening or tube. The flowers are always pendulous; and the pollen falling from anthers can, under favorable circumstances, readily lodge on the nectar." — (*Amer. nat.*, Feb.) W. T. [614

Pollination of the fig. — Some light has been thrown on the much-vexed question of caprification, and the relation of the caprifig or Caprificus to the fig-tree, by the studies of Fritz Müller and Paul Mayer. It appears that the caprifig is the male fig-plant, as Linné believed, and not a distinct race, as Solms-Laubach has recently maintained. Fig-seeds produce both Caprificus and fig-seedlings. The relations between these two forms of an originally monoecious species, and the gall-fly (Blastophagus), on which it now relies for crossing, are very curious. Three broods of the insects each year are brought to maturity in as many crops of flowers of the caprifig; the first two of which are absolutely infertile, while the last does not average one seed to two figs. On arriving at maturity, the wingless males, after escaping from the fruit in which they have developed, seek out other pistils containing females, which, being impregnated before their release, afterward escape, and penetrate other young figs belonging to the next crop, on either caprifig or fig-tree, to oviposit. Being dusted with the pollen of the strongly protogynous flowers from which they have come, they pollinate the receptive stigmas over which they creep; but the flowers of the caprifig only are accessible to their ovipositors. As a result of fertilization, the fig-tree ripens its fruit rapidly, and its seeds are soon scattered by frugivorous birds; but that of the caprifig never becomes eatable. — (Müller, *Kosmos*, Aug. 5, 1882; Mayer, *Mittheil. zool. stat. Neapel*, iii.; Abstracts, *Biolog. central-blatt*, Nov. 15.) W. T. [615

ZOÖLOGY.

Coelenterates.

The origin of the spermatozoa in Medusae. — In a short paper on this subject, Merejkowsky calls attention to the interesting fact, that the mature reproduction-follicle of Cassiopea or Rhizostoma bears a close resemblance to the same organ of Pelagia during its very young stages. At a very early stage of development, the immature follicles are almost exactly alike in all three genera; but in Cassiopea they undergo very little change. The mature organ is a simple ovoidal pouch, lined with endoderm-cells, and filled with spermatozoa. According to the brothers Hertwig, Pelagia passes through a similar stage long before maturity is reached; but its development in this genus does not stop here, and it finally becomes a long irregular pouch, the tortuous ramifications of which are interlaced in an inextricable tangle.

It is easy to discern that the simple pouches of

Cassiopea open, when mature, into the genital sinus, into which Merejkowsky has seen the ripe spermatozoa escape. He believes that similar openings probably exist in Pelagia; and he thinks the failure of the Hertwig brothers to find them is due to the great complexity of the mature follicle in this genus, rather than to the absence of openings.

The paper also contains a minute illustrated account of the transformation of the endoderm-cells which line the follicle into spermatozoa. — (*Arch. zool. exp. gén.*, 1882, 577.) W. K. B. [616

Endodermal nervous system in hydroids. — Dr. Lendenfeld states that he independently discovered in Australian species of Eudendrium and Campanularia the ring of glandular cells which has been recently described by Weissman and Jickeli in Eudendrium. He also finds in all the Campanularidae which he has examined a well-developed nerve-ring of endodermal origin, running around the proboscis, just inside the oral opening. In this region a number of sensory cells are found, with stiff hairs, which project among the cilia of the endoderm-cells. The study of sections shows that these sensory cells are connected with the ganglion-cells; and the processes which are given off from these ganglion-cells anastomose with each other in such a way as to form a complete nerve-ring around the mouth. This ring he regards as the central nervous system of hydroids; and he calls attention to the fact that it not only originates from the endoderm, but is without a homologue in the medusae, since none of the medusae are known to have a nerve-ring in this position. — (*Zool. anz.*, Feb. 5.) W. K. B. [617

Crustaceans.

Color in Idotea. — Carl Matzdorff has published an elaborate and fully illustrated memoir on the color of Idotea tricuspidata (= irrorata), — a variously colored isopod abundant on both sides of the North Atlantic. After describing the various color-varieties, which he arranges in five groups, and the minute structure of the integument, particularly the hypodermal pigment-cells, which he regards as true chromatophores, the author discusses at great length the physiology of the changes of color, and the origin of color-varieties. The changes of color are directly influenced, neither by food, temperature, light, nor saltness of the water, but are sympathetic changes induced by the color of the surrounding objects. Warmth and light, however, accelerate, and cold and darkness retard, the color-changes. As in other animals, changes in color are produced by contraction and dilatation of different sets of chromatophores. The synonymy of the species is discussed, and a long list of works cited is given; but Dr. Matzdorff, while agreeing with Harger, that the American irrorata and the European tricuspidata are the same species, rejects the earlier name because it has been used only by Americans! — (*Jena. zeitschr. naturw.*, xvi. 1.) S. I. S. [618

The Challenger Amphipoda. — The Rev. T. R. R. Stebbing gives preliminary descriptions of some of the more striking new forms of Amphipoda from the Challenger expedition. Only nine species and one genus are described. Unfortunately, no allusion whatever is made to the region or depth from which any of the specimens come. — (*Ann. mag. nat. hist.*, March, 1883.) S. I. S. [619

VERTEBRATES.

The reaction time of olfactory sensations. — The time elapsing between the moment of stimulation and the giving of a signal to indicate the perception of a sensation by the person experimented upon, has been measured for auditory, tactile, visual, and gustatory sensations. Beaunis has now added to the list by a series of observations made on himself in regard to the reaction time of olfactory sensations. From the table which he gives, it is clear that stimuli, as ammonia and acetic acid, which excite, not merely fibres of the gustatory nerve, but also nerves of common sensation, have a shorter reaction time than stimuli which act only or mainly on the nerve-fibres concerned with the sense of smell proper. Excluding ammonia and acetic acid, the table includes camphor, assafoetida, ammonium sulphide, chloroform, carbon disulphide, valerian, mint, and carbolic acid; and the reaction time increases in the above order from .50 to .67 of a second. It was found impossible to determine accurately the moment of olfactory perception of musk. The numbers show that the olfactory reaction time is longer than tactile, visual, or auditory.

In a foot-note the author states, that, since writing his paper, he has learned that Buccola of Turin had been, about the same time, at work on the same subject, and had reached results in the main concordant with those above stated. — (*Comptes rendus*, xcvi. 387). H. N. M. [620

Fine structure of bone. — G. Broesike has published an extensive memoir on this subject (*Archiv mikr. anat.*, xxi. 695), of which Eberth has published an abstract, here reproduced. The first part of the paper deals with the limiting-sheaths of the osseous canal system. The sheaths may be isolated by the action of acids on completely macerated bones. They are but slightly pliable, and reproduce perfectly the forms of the canals. They may be destroyed by certain reagents quicker than the basal substance of bone, from which they are therefore different, their substance resembling keratine in the author's opinion. The sheaths are wanting in embryonic and all young bone. The author speculates as to their origin: he thinks they must arise either as a precipitate from the lymphatic fluids, or else by decalcification of the basal substance. (Neither of these views appears probable.) The osseous corpuscles form a continuous network by the union of their processes. These cells probably have no membrane, and the nucleus soon degenerates. With increasing age, the cells loose their process, and become jagged and smaller, so that there is a space around them; then follows fatty metamorphosis of the protoplasm, and finally complete fatty degeneration, of which the products may be resorbed. The author advances the (very improbable) hypothesis, that the corpuscles are killed by smothering in carbonic acid, accumulated in parts of the bone remote from the blood-vessels. The basal substance consists of uncalcified gelatine, yielding fibrillae, embedded in a calcified cement. The lamellae are formed by primitive layers of fibrillae, which do not intercross and intertwine, although the sets of parallel fibrillae run in various directions. The author distinguishes between regular and irregular fibrillar tissue. — (*Fortschr. med.*, i. 10.) C. S. M. [621

Nerves of the small blood-vessels. — L. Bremer gives a brief *résumé* of previous opinions on this subject, and reports his own observations made principally on frogs and lizards. He asserts that his statements also apply to the warm-blooded vertebrates. The fine capillaries are accompanied by usually two naked nerve-fibres, which anastomose with one another, and give off fine branches which form a plexus around the vessel. The threads of the plexus give off fine knot-like thickenings on the side towards the wall of the vessel, and these knots are the ultimate terminations. On the veins and arteries there are

medullated nerves that give off the naked fibres to form the perivascular plexus. Bremer closes his paper with criticisms of previous writers on the subject. — (*Arch. mikros. anat.*, xxi. 663.) C. S. M. [622

Fish.

A pleuronectoid hybrid. — A curious flatfish was sent to Dr. K. E. H. Krause of Rostock, and has been noticed by him as hybrid between the plaice (Platessa vulgaris) and turbot (Rhombus maximus). No figures or descriptions are given to enable the reader to form an opinion for himself. — (*Arch. ver. freunde naturg. Meckl.*, xxxv. 119.) T. G. [623

The bones of Lophius piscatorius. — An article with this caption has been published by Robert Morrow. The bones of the skeleton are described in the sequence followed by Cuvier, but with Owen's nomenclature. The article is deficient in the clearness and precision which could only result from comparison with related forms. — (*Proc. trans. Nova Scot. inst.*, 5, 340.) T. G. [624

Fishes of Wisconsin. — A Catalogue of the cold-blooded vertebrates of Wisconsin has been furnished by Dr. P. R. Hoy to the geological survey of the state. The classification of the first edition of Jordan's manual has been adopted, and a hundred and forty-two species are catalogued. The list is little more than a nominal one, and is replete with typographical errors. It is not evident, either, to what extent the identifications of species can be relied upon, although the author acknowledges "great obligations to Prof. David S. Jordan, as well as to the lamented Copeland, for valuable assistance in determining species." Dr. Hoy thinks that "Wisconsin has, perhaps, the best facilities for fish-culture of any state in the Union," as there are 'not less than 1,800 lakes,' covering 'some 1,400 square miles,' in the state. — (*Rep. geol. surv. Wisc.*, i. 427.) T. G. [625

Mammals.

Development of the lachrymal duct in mammals. — Von Baer referred the development of the lachrymal canal to an evagination of the pharyngeal cavity; Burdach, to a fold in the skin starting from the corner of the eye. The first to assert that it arises as a groove between the upper jaw and external nasal process was Erdl, whose view was shortly after, but independently, advanced by Coste, and since has been widely accepted. Its accuracy became questionable when Born showed (*Morph. jahrb.*, ii.) that the canal arises in amphibians, lizards, and chicks, as an ingrowth from the inner surface of the epidermis. The ingrowing band becomes subsequently constricted, surrounded by connective tissue, and hollowed out into a canal. Ewetzky (*Arch. für augenheilk.*, viii.) found later the same mode of development in cattle.

E. Legal now reports his investigations on this theme, carried out principally on pigs, but also on mice and rabbits. The first indication of the lachrymal canal is at the time when the nasal pits communicate with the mouth by the primitive choanae, and the Jacobson's canal is well developed, — while externally the so-called lachrymal furrow may be seen (pigs, 4.2 cm., extreme length). The epithelium of the lachrymal furrow is thicker than the rest of the epidermis, because there are one or two layers of cells between the basal cylinder and the superficial flat cells, which elsewhere alone constitute the epidermis. The inner surface of the epidermis of the furrow grows into a ridge, which begins at the opening of Jacobson's organ into the nasal cavity. The ridge grows higher, and finally separates from the skin, forming a rod, the separation becoming completed soonest at the nasal end. The upper end of the rod is connected with the upper lid, but soon forms a stout branch, which grows towards, but does not reach, the lower lid of the eye. The details of the growth of the rod are fully entered into. The canalization begins late, and at the ocular end, and is effected by the separation of the central cells of the rod. — (*Morph. jahrb.*, viii. 353.) C. S. M. [626

Morphology of the mammalian germ. — The strange hypothesis is advanced by Repiachoff, that the impregnated ovum of mammals is a distinct individual, which divides into two individuals. One of the descendants only, Van Beneden's 'entodermatic' segmentation-sphere, grows up like a spore into the complete sexual individual. (This seems over-fanciful.) — (*Zool. anz.*, vi. 65.) C. S. M. [627

Harder's glands in rodents. — Karnocki has recently made some studies upon the nature of these structures in rabbits, guinea-pigs, and rats. In rabbits and hares, in contradistinction to all other rodents, the gland consists of two portions, — a superior (white) and an inferior (reddish gray) half, having a common duct. The latter opens near the free border of the eyelid, and, passing backward directly to the gland, divides, giving off many branches to each half. Within the gland the branching increases until the terminal vesicle is reached. The latter consists of proportionally long, broad, and repeatedly branched serpentine passages, with lateral expansions. There is no constriction of the gland proper at its juncture with the duct. This structure distinguishes the Harderian glands of rodents from true acinose glands, and brings them close to the pyloric and other similar glands. The contents of the glands consist of a protoplasmic stroma in which, in the red portion, large fat globules, but in the white portion only small globules, float. The globules in the red portion vary with the age and condition of the animal.

In guinea-pigs the gland corresponds to the red portion in rabbits. The duct is very small, and hard to find. The fat globules of the secretion are of more equal size than in the rabbit. The Harderian glands of rats contain a large quantity of a granular, red coloring-matter, which is not altered by alkalies or dilute acetic acid, but becomes bleached in dilute mineral acids. The red-colored secretion is confined to that portion of the gland outside the lumen, that within being colorless. It contains no large fat globules.

The remainder of the paper is devoted to the histology and embryology of the glands.

The author doubts if the glands of the corner of the eye in other groups of animals, hitherto described as Harderian glands, are in reality such. — (*Proc. Cracow acad.*; abstr. in *Biol. central-blatt*, ii. 709.) F. W. T. [628

The color of horses. — Notes by a large number of observers upon the color of horses in different parts of the globe have been brought together by Dr. Langkavel in a very interesting manner. White and gray horses are, perhaps, the most general favorites; but a great variety of other colors are held in esteem. It is noticeable that black horses are little sought for, except by Europeans. — (*Zoolog. garten*, xxiv. 38.) F. W. T. [629

The baleen whales. — The recently published part of Van Beneden's description of the vertebrate fossils of the vicinity of Antwerp contains a summary of the present knowledge of the geographical distribution, habits and identity, of existing species of baleen whales. Five species of Balaena, four of Balaenoptera, and two of Megaptera, are recognized. — (*Ann. mus. hist. nat. Belg., pal.*, vii.) F. W. T. [630

ANTHROPOLOGY.

India. — In a course of lectures delivered before the University of Cambridge, entitled 'India: what can it teach us?' published by Longmans, London, Max Müller points out some of the manifold lessons which India can teach all students of history, whether religious, political, or social.

The first is of a general and introductory character. The second is meant to remove some of the prejudices which Europeans often entertain against orientals, and, in particular, to show how groundless is the charge of untruthfulness brought against the natives of India. The third dwells on the study of Sanscrit, with regard both to its practical utility and its historical interest. A new chronological division of Sanscrit literature is put forward.

The author claims a high value for the ancient literature, both Vedic and Buddhistic, showing that some of the greatest problems of all times receive an unexpected light from a study of ancient Sanscrit literature. The two phases of human life and human thought presented to us by the Aryans of India on one side, and by the Aryans of Greece, Italy, and Germany, on the other, are contrasted.

The fourth lecture deals with a number of objections which have been raised against the claims of the Veda as the most ancient historical monument of the whole Aryan world.

In the fifth lecture some of the principal lessons which the Veda can teach are explained. The original character of the Vedic gods is discussed. They are divided into three classes, — gods of the earth, air, and sky.

The sixth lecture deals with the god of fire and of the air. Next follows a description of the gods of the highest heaven. The origin of solar myths is shown to be inevitable.

After an explanation of the manner in which the ancient literature of India was preserved by oral tradition, the last lecture is devoted to an analysis of the ancient Vedic religion into its three compound elements, — a belief in the Devas, or the gods of nature; a belief in the Pitris, or the ancestors; and a belief in the Rita, or the law, order, and reason which underlie both the natural and the moral world.

The text of the seven lectures is followed by Notes and illustrations: 1. The treasures found at Mykenae, and their similarity to treasures found on the Oxus; 2. Names of the cat and the cat's eye; 3. Village estates; 4. Venial untruths, according to Indian views; 5. The Yueh-chi; 6. Some letters on Buddhism; 7. Renaissance of Sanscrit literature; 8. Texts illustrative of the deluge in India; 9. Parganya in German; 10. The Pitris, or fathers; 11. Srâddhas, or ancestral worship.

In the note on the renaissance of Sanscrit literature, evidence has been collected in support of the author's theory that the whole of it, with the exception of the Vedic and Buddhistic, is later than the fourth century of our era. Kâlidâsa's plays are relegated to the sixth century, and the Laws of Manu are assigned to a date not earlier, and possibly much later, than the fourth century after Christ. — H. W. H. [631

Iroquois. — Under title of 'Legends, traditions, and laws of the Iroquois,' Eliah Johnson, a Tuscarora chief, engages in the very laudable attempt "to animate a kinder feeling between the white people and the Indians, established by a truer knowledge of our civil and domestic life, and of our capabilities for future elevation." It needs but a cursory examination to show that the manner in which the desired end is to be attained was by no means clear to the writer's mind; and it is not probable that the book will have the success which the evident sincerity and earnestness that pervade it would seem to deserve. Some of the historical facts presented are interesting, and certain of the traditions are of value to the student of ethnology. Under the heading 'Creation' is an interesting Tuscarora tradition, treating of the beginning of the world, and the formation of the celebrated league.

Who were the Squawkihaws, Kah-Kwahs, and the Eries, has always been an enigma; and in answering that the three were formerly known as Squawkihaws, a remote branch of the Senecas, and speaking the same language, the author has done a service to all students who interest themselves in tribal nomenclature and relationships.

The tradition relating to the expulsion of the Squawkihaws, or, as they have been usually called, the Eries, is peculiarly interesting and important, inasmuch as it is stated with all desirable precision, that, after a hot pursuit by the Senecas, a considerable portion of the tribe succeeded in making their escape, and, as was supposed, disappeared in the Far West under a changed name, leaving a large number of prisoners to be adopted into the conquering tribe.

The Jesuit relations contain the generally accepted idea that the Eries were utterly exterminated, — one of the many instances where extermination, so called, really means a comparatively small number killed, and a large remnant incorporated into other tribes. The tribal name, indeed, is lost; but the individual members of the tribe live on under new tribal ties. — H. W. H. [632

The distribution of the Negritos. — M. A. de Quatrefages sends us, in pamphlet form, his paper, which appeared in vol. i. of the *Revue d'ethnographie* (111–161), upon the geographic distribution of the Negritos, and upon their identification with the Asiatic pygmies of Ctesias and Pliny. The author, like Crawford, Pickering, and many others, distinguishes two dark-skinned races in the Australasian and Malaysian area, — the Papuans and the Negritos. The former are large, muscular, and have their crania dolichocephalic and hypsistenocephalic; the latter are short, plump, and brachycephalic or sub-brachycephalic (0.80 and upwards). A few words are devoted by M. de Quatrefages to the former; the bulk of the essay, to the latter. When the Spaniards began to colonize the Philippines, they met in the interior of Luzon, beside the Tagals, of Malay origin, black people, with woolly hair, short in stature, and living in the mountains, to whom they gave the name *Negritos del monte*. The local name was *Aigtas* (Aëtas), 'black.' Under diverse names they are found, either pure or mixed, in the midst of other peoples, from the south-east extremity of New Guinea to the Andaman Archipelago, and from the Sunda Island to Japan. M. de Quatrefages is acknowledged to be the most indefatigable anthropologist in France, and in this monograph, as well as in others relating to the same subject, has thrown much light upon the Negrito race. We must demur, however, to the *a priori* methods employed in the last part of the essay, wherein he adopts the pygmies of the classical writers. — J. W. P. [633

Voyages of Moncatch-Apé. — M. Le Page du Pratz, in his *Histoire de la Louisiane*, tells of a voyage made by Moncatch-Apé, a Yazoo Indian, up the Mississippi and the Missouri Rivers, across the Rocky Mountains, and down the Columbia to the Pacific Ocean. He there ascertained the trend of the coast north-westward, and the existence of the peninsula of Alaska. From his narrative we also learn of white

men, bearded, and carrying fire-arms, not Europeans, coming annually to the mouth of the Columbia to procure dye-woods, and occasionally to carry off slaves. M. de Quatrefages revives this narrative with notes and comments, arriving at the following conclusions: 1. Neither when du Pratz was in Louisiana nor when he published his book was there sufficient geographical knowledge to invent the story told by Moncatch-Apé; 2. The voyage was really accomplished; 3. The truth of Moncatch-Apé relative to waters, productions, inhabitants, etc., renders his story about bearded white men plausible; 4. The agreement of his account of the bearded white men with that of Basil Hall and others, concerning the people of Loo Choo, leads to the presumption that they were speaking of the same people; 5. Therefore, anteriorly to the advent of Europeans, the mouth of the Columbia was visited by this people. It is best always to allow writers to speak for themselves, and to stand or fall on their own merit. But it does seem that the distinguished anthropologist is grasping at a straw. — (*Rev. d'anthrop.*, (2) iv. 593.) J. W. P. [634

The report of Professor Baird. — Although all the matter of the Smithsonian annual report has been in the printer's hands a year, the preliminary portion, or report proper, has just appeared, and the volume, or appendix, still drags its slow length along. Under the guardianship of the Smithsonian institution are to be found several quite distinct enterprises; such as the International scientific exchanges, the Museum of archeology, the National museum, the Fish commission, and the Bureau of ethnology. A full account of the operations in each of these departments will be found in the report of Professor Baird. Here we shall speak of anthropology only. During the year 1881, Mr. S. T. Walker explored Indian mounds and graves in Florida; Judge J. G. Henderson of Illinois completed his investigations of the mounds of that state; Mr. S. B. Evans and Mr. F. A. Ober conducted some explorations in Mexico; Mr. L. Guesde of Guadalupe sends a portfolio of beautiful water-color sketches of West-Indian polished-stone implements, with descriptions; Mr. Nelson adds to his already splendid collection of Esquimaux culture-objects. Mention is made of the following publications: Bransford's Antiquities of Nicaragua, the Annual report of 1880, and Vol. xxiii. of the Contributions to knowledge. The work of the ethnological bureau in 1881 included the explorations of Mr. Cushing, Col. Stevenson, Dr. E. Palmer, Mr. W. J. Taylor, Mr. S. T. Walker, Major Powell, Mr. Mendeleff, Mr. J. K. Hillers, Tichkematse, and George Tsaroff. — J. W. P. [635

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

Invertebrate fossils of Brazil. — The museum has received from Museu nacional of Brazil, through Dr. Orville A. Derby, the first set of duplicates of the invertebrate fossils acquired during the recent geological exploration of that country. The collection comprises about seventy species of fossil gasteropods, the greater proportion of which are now being described for the first time, together with other invertebrates equally interesting.

Lectures upon materia medica. — A course of eight lectures upon materia medica, based upon and illustrated by the collection in the national museum, will be delivered by Dr. D. Webster Prentiss. The course will open on the 7th of April, and be continued on consecutive Saturdays. Admission will be by ticket.

Naval bureau of ordnance.

Gunnery. — A series of experiments has been commenced at the Naval experimental battery near Annapolis, Md., with the breech-loading steel rifle recently completed at the South Boston iron-works.

With a charge of 25 pounds of powder, and a projectile weighing 68 pounds, a muzzle-velocity of 1,996 feet per second has been attained, with a pressure in the bore of the gun of but 27,000 pounds per square inch. This gun has a calibre of six inches, a bore fifteen feet in length, and is capable of withstanding an internal pressure of 55,000 pounds per square inch. Considering the conditions of chamber-space (920 cubic inches), length of bore, and weight of projectile, the results are unsurpassed by any hitherto obtained abroad. — J. M. R.

Annapolis, March 21.

Ordnance experiments. — The experiments with the new six-inch rifle have been continued this week by Lieut. Commander W. M. Folger, who is in charge of the experimental battery at this place. Yesterday a projectile weighing 68 pounds was discharged with a muzzle velocity of 2,130 feet per second, the charge of powder being 32 pounds, and the pressure 30,720 pounds per square inch. The velocity was ascertained by means of two Le Boule chronographs working independently, the difference between the results recorded being only a few feet. — J. M. R.

Annapolis, March 23.

Department of agriculture.

Contagious diseases of animals. — The subject of the prevention and cure of contagious diseases of animals has for many years been considered in this country. For a long time, extirpation was resorted to, and with good results; notably in the work of the commission appointed by the state of Massachusetts in 1860, which entirely succeeded in freeing that state of pleuro-pneumonia. Of late years, inoculation or vaccination has been employed with such success abroad, by Pasteur, that we are justified in anticipating the most beneficial results from the prosecution of his methods in this country. Pasteur has been engaged in efforts to establish some law, through the agency of which such diseases as pleuro-pneumonia, charbon, foot and mouth disease, and other diseases of domestic animals, could be controlled and cured. Dr. D. E. Salmon has been pursuing similar experiments under the direction of the department, though necessarily in a more limited way, and has met with such success that he has great faith in the result of the more elaborate and extensive experiments which he is about to undertake in the District of Columbia. Commissioner Loring has determined to place at the disposal of Dr. Salmon the necessary land, buildings, animals, and apparatus, to enable him to make the proper microscopical observations, and to carry on any experiments that will tend to establish some economical method by which our farmers or breeders may control the diseases of their animals. Dr. Sal-

mon is of the opinion that such diseases as Texas fever, charbon, and pleuro-pneumonia, are the results of germs which he has found in his post-mortem examinations, and that it is possible to protect unaffected animals from these diseases by dilute inoculation.

The precautions which the government has taken to prevent the importation of infectious diseases from abroad, by the establishment of quarantine stations, are praiseworthy, and it is of the greatest importance that proper regulations relative to the transportation of infected cattle from place to place should be adopted; but it is manifestly of far greater importance to ascertain the laws which control the diseases themselves, and to discover some cheap and obtainable means by which the farmer can protect his herds when attacked.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody museum of American archaeology, Cambridge, Mass.

Stone graves of the Cumberland valley. — In what was formerly an extensive cemetery covering several acres, at Brentwood, Tenn., eighty graves which had not been disturbed were opened during explorations the past summer. These graves were made by placing slabs of stone edgewise, forming the sides and ends of the graves; and on these, other flat stones were placed after the body was deposited. The bottoms of these cists were sometimes lined with small stones, but oftener with large potsherds. In some instances the lining was probably of bark. In several of these graves, two or three, and even, in one instance, five bodies were buried. In two graves, besides the skeleton of the person for whom each grave was made, one or two bones were found belonging to a second individual, in such positions as showed that they had been carefully placed in the grave. In one grave containing five skeletons, two of the three adult crania had persistent frontal sutures; and these were the only crania, in all the eighty graves, presenting this peculiarity. One adult skull had an extra suture, dividing the parietal of the left side into two nearly equal portions. This skull was also remarkable for the extreme occipital flattening, and great development of large Wormian bones; also for the absence of the two lateral incisors of the upper jaw, which, if they were ever present, must have been lost early in life, as all signs of the alveoli, or of wide gaps between the teeth, were obliterated. Many bones bearing evidence of simple inflammatory disease, but none of any specific taint, and several showing united fractures, were also found.

The pottery resembles in type that from the Missouri graves, but is, as a whole, of better finish. There were no large and coarse vessels in the graves, although the large fragments of thick pottery with which the bottoms of many graves were lined show that large vessels were made. The pottery from the stone graves consists principally of water-bottles of various shapes, small food-dishes, and bowls. Some of these are ornamented by incised lines, and others by designs in colors. Among the stone implements found were a large and finely polished celt of chert, several long chipped points with serrated edges, and a few arrow-heads, one of which was found embedded in a dorsal vertebra of the skeleton in the grave. Several implements and ornaments made of bone were obtained, among them two long bone pins with large, flat heads, — both found close to skulls, suggesting that they were probably used for hair-ornaments; also a number of shell and terra-cotta beads, and a single carved disk of shell, resembling those previously found in the stone graves of the Cumberland valley; together with a clay pipe having an ornamental bowl. Only eight pipes have previously been obtained in the several thousand graves which have been explored for the museum. Of these eight, three were of pottery, and the rest of different kinds of stone; one of the latter was elaborately carved, representing a man holding a cooking-pot which formed the bowl of the pipe.

An interesting discovery was made in the cemetery near the top of the hill, which at this place had gradually been gullied, and disclosed a mass of charcoal. On removing with a trowel all the earth about the charcoal, it proved to be the remains of burnt logs. A man was kept at work for several days following out the lines of charcoal and burnt clay; and after a time he succeeded in bringing to light, from under a few inches of clay, the charred floor-beams of a wooden structure of some sort. Within the enclosure formed by the charred logs were discovered a bed of ashes, a number of fragments of pottery, one perfect dish identical in character with those found in the stone graves near by; also a few burnt bones, two small discoidal stones, and two discoidal pieces of pottery. The logs had been supported by clay, which partly covered them, and thus prevented their total destruction when the building, of whose floor they formed a part, was destroyed by fire. About ten feet in length and five in width of this structure were traced, of which a drawing was made before any thing was disturbed. While stone graves were found on all sides, and within ten to twenty feet of the site of this structure, none were discovered under it; and there seems no reasonable doubt that these charred logs were the remains of a wooden structure of the period of the stone graves.

NOTES AND NEWS.

— In continuation of the work of establishing and verifying secondary meridians of longitude, Lieut.-Commander F. M. Green, assisted by Lieut.-Commander C. H. Davis and Lieut. J. A. Norris, U.S.N., under the direction of the Bureau of navigation, has determined a chain of geographical positions, commencing at Madras, in British India, and extending through the China and Japan Seas to Vladivostok, in Siberia. The stations occupied were Vladivostok, Yokohama, Nagasaki, Shanghai, Amoy, Hong-Kong, Manila, Cape St. James, Singapore, and Madras.

In measuring differences of longitude, the method adopted was in all cases to establish portable observatories in each of the two places between which the measurement was to be made, connecting the observatories with the telegraph-offices by short lines; so that the two observers were in telegraphic communication with each other. The errors of the chronometers on local time were then determined by means of numerous star-transits, and the chronometers were compared by repeated telegraphic signals sent both ways over the cable. The latitudes were determined by zenith telescope observations of pairs of well-determined stars.

A full account of the work, with details of the observations and computations, has been prepared, and will be published by the U. S. navy department.

— The seventeenth annual course of lectures to mechanics at the Sheffield scientific school, New Haven, Conn., just completed, embraced the following subjects: The Luray caverns as seen by electric light, Rev. H. C. Hovey; The transit of Venus, Professor Newton; Modern fiction, Mr. Charles Dudley Warner; Photo-chemistry of the retina, Prof. R. H. Chittenden; The trades-unions of the middle ages, Professor Farnam; The history of Connecticut as illustrated in the names of its towns, Professor Franklin B. Dexter; Domestication of animals, Prof. W. H. Brewer; Heat and work (two lectures), Prof. A. Jay Du Bois; The Veda, Prof. W. D. Whitney; Facts illustrative of the Darwinian theory, Prof. A. E. Verrill; The agency of insects in the fertilization of flowers, Dr. E. H. Jenkins.

— The Woman's education association of Boston has made arrangements with Professor George L. Goodale and Dr. W. P. Wilson for a course of ten lectures upon the relation of plants and animals to food. The course is now in progress, on Tuesdays and Fridays, at 11 A.M., in the lecture-room of the Boston society of natural history, having begun on Tuesday, March 27.

— *The American* reports that the Virginia board of education has accepted the Griffin farm, near Petersburg, as the site for the Colored normal and collegiate institute, provided the city council of Petersburg will give five thousand dollars. The college building will be erected near the spot where the memorable 'crater' fight occurred during the war; and the amount appropriated by the legislature for the establishment of the school is one hundred thousand dollars.

— "It is expected," says *Nature*, "that the French government will take in hand the celebration of the centenary of the discovery of balloons. The two committees which had been formed by several aeronautic societies have been amalgamated, and M. Gaston Tissandier has been appointed president. The scheme of an international exhibition for balloons and instruments used in aerial investigations has been adopted by M. Herrisson, the minister of public works, and will be carried into effect by M. Armengaud Jeane, the well-known civil engineer."

— A meeting of the U.S. naval institute was held at Annapolis, March 28, to consider the prize essay for 1883. The subject was, "How may the sphere of usefulness of naval officers be extended in time of peace with advantage to the country and the naval service?" The prize, consisting of a gold medal, one hundred dollars, and a life-membership, was awarded to Lieut. C. G. Calkins, while the essays of Commander N. H. Farquhar and Commander A. P. Cooke received honorable mention. The judges of the relative merits of the essays were Ex-Gov. Alexander H. Rice, Rear-Admiral George H. Preble, and Judge Josiah G. Abbot.

— At the meeting of the Biological society of Washington, March 30, Mr. Newton P. Scudder read a paper on The length of the hatching-period of the domestic fowl, and was followed by Dr. Thomas Taylor, on Section-cutting and mounting of hard woods, and A new parasite in fowls, of the nature of Trichina; Prof. J. W. Chickering, jun., on Mount Kataadn; Prof. L. F. Ward, on Hybrid oaks of the District of Columbia. During the meeting there was an exhibition of specimens (limited to five minutes each), illustrating accidents to animals, by Mr. F. A. Lucas; the bones of the sea-cow (Rhytina), by Mr. F. W. True; another jumping-seed, Remarks on bee-fly larvae and their singular habits, A burrowing butterfly larva, — by Prof. C. V. Riley.

— Rev. R. W. Logan, missionary of the American board of missions at Ponape, Micronesia, states that the remains of buildings, etc., represented to be found at Ponape, are simply basaltic columns such as are found at Staffa. There is no mark of their having ever been used for buildings, and they bear neither inscriptions nor other sculptures.

— The third annual exhibition of the society of American taxidermists will be held in New York, opening to the public at Lyric Hall, 723 Sixth Avenue, on May 1, and continuing five days. The general meeting will also be held during the same week. Since the Boston exhibition, the society has nearly doubled its membership; and the exhibits entered for New York give promise of a very extensive and attractive display. Inasmuch as this organization has for its special aim the improvement of museum taxidermy, in which there is certainly wide room, its work is an important one, and of great interest to all who visit our American museums.

— The English national smoke-abatement institution is making arrangements for opening a permanent exhibition in a central part of London. It will be free to the public. A hall for the reading of papers and the instruction of classes will be provided; also testing-rooms for the continuation of the series of tests and trials commenced in connection with the South Kensington and Manchester smoke-abatement exhibition of 1882. Particulars may be obtained at the offices of the national smoke-abatement institution, 44 Berner's Street, Oxford Street, London, W. —

— S. E. Cassino & Co. of Boston announce a revised translation of Haeckel's letters of Indian travel, by J. S. Kingsley; The history and uses of limestones and marbles, by S. M. Burnham; A handbook of entomology, by C. V. Riley; and Tables for the use of students and beginners in vegetable histology, by D. P. Penhallow.

— The treasurer of the Balfour memorial fund acknowledges the following subscriptions: Dr. R. H. Fitz, Harvard medical school, $10; Professor Asa Gray, Harvard, $5; Prof. H. P. Bowditch, Harvard medical school, $5; medical classes, '83, '84, '85, Univ. of Michigan, $23.25; previously acknowledged, $423.

— The Bureau of ethnology has just received a copy of Duruy's photographic reproduction of the Maya Codex, known as the 'Manuscript dit Mexicain, or Codex peresianus.' According to Dr. Brinton, only ten copies of this work were issued, one of which is in his library. The one received by the bureau is, therefore, the second which has found its way to this country.

— The more prominent geographers deceased in the year 1882 are: Antinori, known for his travels in Africa; Crevaux, supposed to have been killed by Indians while descending the Pilcomayo; Darwin, who began his great work by a voyage around the world; Delitsch, most widely known as editor of Aus allen welttheilen; Desor, whose work was chiefly geological, in Switzerland and this country; Gill, an explorer of inner China, massacred with Palmer, by the Arabs on the Sinai peninsula; Lütke, the Russian navigator; Parish, author of works on the Argentine Republic; Petherick, an early explorer of the upper Nile; Nain Singh, the most celebrated traveller of the Indian pundits; Rawson, a member of the recent English arctic expedition under Nares, who died from wounds received at Tel-el-Kebir; Rodgers, of our navy, an explorer of the northern Pacific and Arctic; H. v. Schlagintweit-Sakünlünski, one of the three brothers widely known for their explorations in the Alps, and later in India and central Asia; Wyville Thomson, chief of the scientific staff of the Challenger; and Warren, of our engineer department.

—The zoölogical gardens at Cincinnati seem to be in a flourishing condition. The receipts for 1882 were nearly $50,000 ($3,418 in excess of expenditures), of which nearly $30,000 came from gate-money. The animals on exhibition numbered nearly 800; and among those bred in the garden during the year were grizzly bears, the zebu, the bison, and half a dozen kinds of deer.

— In SCIENCE, p. 266, column 1, line 8, for 'dollars' read 'shillings.'

RECENT BOOKS AND PAMPHLETS.

Behrens, Wilhelm. Hilfsbuch zur ausführung mikroscopischer untersuchungen im botanischen laboratorium. Braunschweig, *Schwetschke*, 1883. 12+398 p., illustr. 8°.

Boudet de Paris, M. Des applications du téléphone et du microphone à la physiologie et à la clinique. Paris, *Henry*, 1880. 11+171 p. 8°.

Brass, Arnold. Zur kenntniss der eibildung und der ersten entwicklungsstadien bei den viviparen aphiden. Halle, *Schwetschke*, 1883. 40 p., illustr. 8°.

Cavallero, Agostino. Le macchine a vapore, il materiale e l'esercizio tecnico delle strade ferrate: termo-dinamica-aerodinamica. Forino, *tip. Camilla e Bertolero*, 1883. 24+705 p., illustr. 8°.

Claparède, Alexandre. Quelques nouvelles kétones aromatiques obtenues par condensation moléculaire. Dissertation présentée à la faculté des sciences de l'université de Genève. Genève, *Georg*, 1882. 63 p. 8°.

Compagnie internationale des téléphones. Situation des réseaux téléphoniques. Paris, *Dupont*, 1883. 53 p. 4°.

Deutsche botanische gesellschaft. Berichte. i. heft. Berlin, *Bornträger*, 1883. 56 p. 8°.

Duclau. La science vulgarisée. L'éclairage au gaz et la lampe de sûreté, leçons populaires mises au niveau de la science moderne. Limoges, *Ardant*, 1883. 143 p. 8°.

—— *The same.* Les cristaux et la cristallisation. Limoges, *Ardant*, 1883. 144 p. 8°.

Entomological papers from the transactions of the Iowa state horticultural society for the year 1882. Des Moines, *Mills pr.*, 1883. 42 p. 8°.

Filachon, J. E. Principes de cosmologie. Paris, *Durand et Pedone-Lauriel*, 1883. 87 p., illustr. 12°.

Girard, M. Les insectes. Traité élémentaire d'entomologie. Tom. iii. fasc. i. Hyménoptères térébrants; macrolépidoptères. Paris, *Baillière*, 1883. 640 p., illustr. 8°.

Godefroy-Lebeuf et Bois. Les plantes vivaces de la maison Lebeuf, ou Liste des espèces les plus intéressantes cultivées dans cet établissement, avec quelques renseignements sur leur culture, etc. Argenteuil, *Godefroy-Lebeuf*, 1883. 180 p., illustr. 18°.

Graham, R. Algebraic factors: Resolution of elementary algebraic expressions into simple factors by easy methods; with numerous examples and exercises. Dublin, *Ponsonby*, 1883. 100 p. 12°.

Grégoire, L. Nueva geografia universal. Traducida y ampliada por D. Nicolas Estevanez. Tom. i. Paris, *Garnier*, 1883. 8+799 p., illustr. 4°.

Guyard, S. Melanges d'assyriologie, notes de lexicographie assyrienne, suivies d'une étude sur les inscriptions de Van. Paris, *Maisonneuve*, 1883. 2+148 p. 8°.

Jouffret, E. Introduction à la théorie de l'énergie. Paris, *Gauthier-Villars*, 1883. 200 p. 8°.

Klein, D. Sur les acides borotungstiques. Paris, *Gauthier Villars*, 1883. 87 p. 4°.

Krieg, Otto. Die dobschauer eishöhle u. gletscherspuren im Riesengebirge. Vortrag in der aula d. gymnasiums zu Hirschberg am Jan. 22. Hirschberg, *Richter*, 1883. 39 p. 8°.

Kruger, Paul. Rotations-und pendelbewegung eines körpers in einer flüssigkeit. Inaugural dissertation. Danzig, 1882. 42 p. 8°.

Martin, H. N., *and others.* Lectures delivered to the employees of the Baltimore and Ohio Railroad Company, by Prof. H. Newell Martin and Drs. Henry Sewall, William T. Sedgwick, and William K. Brooks. Baltimore, *Friedenwald pr.*, 1882. 98 p., illustr. 8°.

Meyer, Loth, u. **Seubert**, Karl. Atomgewichte der elemente aus den originalzahlen neu betrachtet. Leipzig, *Breitkopf & Härtel*, 1883. 10+245 p. 8°.

Moncel, Count Th. du. Elements of construction for electro-magnets. Translated from the French by C. J. Wharton. London and N. Y., *Spon*, 1883. 90 p. 8°.

Munker, J. G. Grundsätze der electrodynamik, synthetisch hergeleitet u. experimental geprüft. Nürnberg, *v. Ebner*, 1883. 4+27 p., illustr. 8°.

New Jersey—Geological survey. A topographical map of a part of northern New Jersey, from surveys and levellings made and local surveys corrected by George W. Howell and C. C. Vermeule upon a projection made by the U. S. coast and geodetic survey. *Bien, lith*, 1882. Scale, 1 m. to 1 in. 87.5×88.5 cm.

Orchauski. Recherches craniologiques sur une série de crânes d'assassins. Paris, *Hennayer*, 1883. 13 p. 8°.

Reade, A. A. Study and stimulants; or, the Use of intoxicants and narcotics in relation to intellectual life as illustrated by personal communications on the subject from men of letters and science. Manchester, *Heywood*, 1883. 204 p. 8°.

Sbriziolo, Marco. Trattato di chimica analitica qualitativa e quantitativa. Napoli, *Eschera*, 1883. 574 p. 16°.

—— Trattato di chimica generale inorganica ed organica, esposto sotto il punto di vista della dottrina moderna. Napoli, 1883. Illustr. 8.°

Schiaparelli, G. V. Misure di alcune principali stelle doppie di rapido movimento orbitale. Milano, *tip. Lombardi*, 1883. 43 p. 8°.

Science nouvelle (La). Red. Adolphe Bitard. 1re ann. no. 1, Mars 15. Paris, 1883. 8 p., illustr. 8°. *w.*

Seaton, A. E. A manual of marine engineering: comprising the designing, construction, and working of marine machinery. London, 1883. 446 p., illustr. 8°.

Ulmi, K. Populäre mittheilungen über heizung und ventilation. Mit vorschlägen zur einführung der antiken heizungs-und ventilationsmethode, zum gebrauch für hausbesitzer, anstaltsvorsteher, und bauhandwerker. Bern, *Krebs*, 1883. 144 p. 8°.

United States geological survey. Bulletin No. 1. Washington, *Government*, 1883. 42 p., 2 pl. 8°.

Vicentini, Giuseppe. Gli elettromagneti. Roma, *tip. Cecchini*, 1882. 45 p. 8°.

Lantern Attachments, Plain and Colored Slides, Accessories, Novelties, etc., constantly on hand, or made to order.
Marcy's Sciopticon is the best instrument for scientific purposes and popular illustrated lectures. Send for illustrated catalogues free.
L. J. MARCY, 1340 Chestnut Street, Philadelphia, Penn.

GEORGE H. BARRUS,
CONSULTING STEAM-ENGINEER,
79 MILK STREET, BOSTON,
Makes a specialty of the economical production and use of steam.
GEORGE H. BARRUS, Boston.

CHARLES WILLIAMS, JUN.
(Established 1856),
109 AND 115 COURT STREET, BOSTON, MASS.,
manufacturer of
TELEGRAPHIC, ELECTRICAL, AND MAGNETICAL APPARATUS.
Call-Bells, Annunciators, Telegraph Instruments, Batteries, Medical Machines, Office, Annunciator, Silk and Cotton Covered, and Line Wire, Insulators, Brackets, etc. Telegraphic, Telephonic, and Electrical Material of all kinds.

TELESCOPES, Photographic Outfits for Amateurs, Opera-Glasses, Spectacles, Microscopes, etc. R. & J. BECK,
1216 Chestnut Street, Philadelphia, Penn.
Send for Illustrated Price Catalogue.

WADSWORTH BROS. & HOWLAND,
IMPORTERS AND DEALERS IN
Artists' Materials and Architects' and Engineers' Stationery,
84 Washington and 46 Friend Streets, Boston.
Catalogues free upon application.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.
Engraver on Wood. References, American Steam Gauge Co., Boston Journal of Commerce.

PORTRAITS IN OIL OR CRAYON.
MAZEPPA SIGN COMPANY,
Scollay Square, Boston, Mass.

SULLIVAN BROTHERS & LIBBIE,
AUCTIONEERS.
SALESROOM . . . No. 2 BEACON STREET,
BOSTON, MASS.

Special facilities for the display and sale, by auction, of private libraries (large or small), autographs, coins, paintings, engravings, works of art, furniture, fancy goods, etc. Catalogues sent to, and orders executed for, librarians and bookbuyers gratis.

SCIENTIFIC BOOKS FOR SALE.
Lippincott's Encyclopædia of Chemistry. Edition, 1877. Two volumes. 2056 pages. Retail price, $24; in good condition, price $14.
American Pharmaceutical Proceedings, 1879 and 1880. $2 each.
Parrish's Pharmacy, revised by Wiegand, 1874. $2. Attfield's Pharmacopeia, 1873. $2.
Address, ROBERT LUCE, 54 Weld, Cambridge.

RARE BOOKS FOR LIBRARIES AND Scientific Men at very low prices. Verdet's Works (8 vols.), Britannia and Conway Bridges (2 vols. text, 1 vol. plates), Reports U. S. Commissioners at Paris Exposition, 1867 (6 vols.), Life and Works of Dr. T. Young (4 vols.), Works of G. Green and R. Ellis, Jellett's Calculus of Variations, Smith's Optics (2 vols.), Robison's Mechanical Philosophy (4 vols.), Smith. Reports (11 vols.), Mathematical Monthly (3 vols.), and others. For price, binding, etc., address G. A. Hill, 24 Coll. House, Cambridge.

THE PORTABLE BOOKCASE (Patented).
For descriptive circular and price-list, address the sole makers, LOCKWOOD, BROOKS, & Co., 17 Franklin Street, Boston.

JUST PUBLISHED.
Crown 8vo. Cloth. 75 cents. Postpaid.

ELEMENTS OF CONSTRUCTION FOR ELECTRO-MAGNETS.

By Count Th. du Moncel, Membre de L'Institut de France. Translated from the French by C. J. Wharton.

E. & F. N. SPON, Publishers and Importers,
No. 44 Murray Street, New York.

WILLIAM J. WILSON,
CLOTH AND PAMPHLET BINDER,
No. 96 Milk Street, Boston.
Near Post-Office Square.

CASHMAN, KEATING, & CO.,
PRINTERS,
Fayette Court, 603 Washington Street, Boston.
JOHN CASHMAN. JAMES KEATING.

RARE GEMS AND MINERALS.
W. J. KNOWLTON, Mineralogist, 168 Tremont Street, Boston. Persons desiring fine gems will be repaid for examining my stock.

FLORENCE KNITTING-SILK, made by the Nonotuck Silk Co., has invariably given satisfaction in quality, and always holds out full in quantity.

KNIGHT'S AMERICAN
MECHANICAL DICTIONARY.

A descriptive word-book of tools, instruments, machines, chemical and mechanical processes; civil, mechanical, railway, hydraulic, and military engineering; a history of inventions; general technological vocabulary; and digest of mechanical appliances in science and the industrial and fine arts.

By EDWARD H. KNIGHT, A.M., LL.D., Civil and Mechanical Engineer.

HOUGHTON, MIFFLIN, & CO.,
PUBLISHERS, BOSTON.

SPECIMEN PART MAILED FREE TO ANY ADDRESS.

CHEMICAL TEXT-BOOKS.
BY JOHN HOWARD APPLETON,
Professor of Chemistry in Brown University.

1. The Young Chemist	Price	.90
2. Qualitative Analysis	"	.90
3. Quantitative Analysis	"	$1.50
4. Laboratory Handbook	"	.12

These books are unsurpassed in the help they afford to teachers.

Copies sent by mail, postpaid, upon receipt of the advertised price, by

G. ROSCOE & COMPANY,
Box 17, PROVIDENCE, R.I.

A COMPLETE CATALOGUE OF WORKS on Phrenology, Physiognomy, Health, Magnetism, etc., and a back number of The Phrenological Journal, sent free on application to FOWLER & WELLS, Publishers, 753 Broadway, New York.

B. WESTERMANN & CO.
[Established 1848].
838 Broadway . . . . New York.
Importers and Booksellers of Foreign Books. Weekly Importations from all parts of Europe.

"ODDS AND ENDS." Pamphlets scarce and otherwise, Historical, Medical Reports, Magazines, Reviews, second-hand School-Books. Pick-up orders solicited.
A. S. CLARK, 34 Park Row, New York City.

HENRY C. DIMOND & CO.,
Manufacturers of and dealers in Self-Inking Stamps, Rubber and Metal Stamps of all kinds. Ribbon Stamps, Seal-Presses, Inks, Ribbons, Seals, Dies, etc. Repairing a specialty.
22 Milk Street, Boston, Mass.

UNMOUNTED PHOTOGRAPHS of ancient and modern works of art, reproductions of famous original paintings, sculpture, architecture, etc. Send 6-cent stamp for catalogue of 5,000 subjects. SOULE PHOTOGRAPH CO., 338 Washington Street, Boston, Mass.

WHITNEY, HOWE, & SIBLEY,
Bankers and Brokers. Stocks, bonds, and investment securities bought and sold.
Stocks carried on margin. Stocks at auction every Saturday at 1 o'clock, P.M.
No. 7 Exchange Place, Boston.

J. W. COLBURN & Co.
Dynamo-Electric Machines
Fitchburg, Mass.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada, $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

Moses King, Publisher of "Science,"
Cambridge, Mass.:

Dear Sir: In accordance with your request we herewith furnish you a detailed statement of the Sixty-nine thousand -69.000- copies we have actually printed of the illustrated weekly journal, "Science," and have made affidavit to same before a justice of peace:

No. 1.	Feb. 9.	6000 copies	No. 6.	Mar. 16.	6000 copies.
2.	Feb. 16.	6000 "	7.	Mar. 23.	10000 "
3.	Feb. 23.	6000 "	8.	Mar. 30.	6000 "
4.	Mar. 2.	7000 "	9.	April 6.	6000 "
5.	Mar. 9.	10000 "	10.	April 13.	6000 "

A total for ten issues of 69.000 Copies.

It is our understanding that the regular issue of Science is never to be less than six thousand (6000) copies every week; and that during the year we are to print fully four hundred thousand (400.000) copies.

Respectfully yours

Rand, Avery & Co.

Commonwealth of Massachusetts } s.s. Boston April 16/83.
County of Suffolk }
Personally appeared Avery L. Rand to me well known as the member of the firm of Rand, Avery & Co. who signed said firm's name to the foregoing and made solemn oath that the statements therein contained are true. Jno. C. Paige Justice of the Peace

Photo-Electrotype Co., Boston.

Judicious advertisers who have unquestionably good wares to sell will find the columns of "Science" an unsurpassed medium of reaching, every week, several thousand educated, wealthy, and broad-minded people all over the world.

Our subscription-list, now approaching two thousand subscribers, at $5 a year, is rapidly increasing.

No paper of the high standard of "Science" ever before met with its success in America.

For subscriptions or advertising, address

MOSES KING,
Publisher,

Cambridge, Mass.

SCIENCE.

AN ILLUSTRATED JOURNAL, PUBLISHED WEEKLY.

OWNED BY

THE SCIENCE COMPANY.

OFFICERS AND DIRECTORS.

D. C. GILMAN, OF BALTIMORE, *President.*
GARDINER G. HUBBARD, OF WASHINGTON.
ALEXANDER GRAHAM BELL, OF WASHINGTON, *Vice-President.*
OTHNIEL C. MARSH, OF NEW HAVEN.
SAMUEL H. SCUDDER, OF CAMBRIDGE, *Treasurer.*

SUBSCRIPTIONS.—In United States and Canada, $5 a year.
In Great Britain and Europe, $6 a year.

ADVERTISEMENTS.—$60 a page, each insertion. Parts of pages in proportion.

MOSES KING, *Publisher*, CAMBRIDGE, MASS.

FRIDAY, APRIL 20, 1883.

SCIENCE FOR WORKING-MEN.

A COURSE of four lectures, delivered by members of Johns Hopkins university to the employees of the Baltimore and Ohio railroad, has recently been published for free distribution to the auditors.

As these lectures are simple demonstrations of elementary facts, they have, despite the admirable method that characterizes them, and the excellent illustrations of the text, only an occasional interest to the general public. But they have a very real value in that they mark an effort to accomplish a work of genuine instruction among a class of our people where there is the sorest need of all intellectual help.

These lectures originated, as it were, accidentally, as is the case, indeed, with most good enterprises. This railway company had tried to do something for its people by founding a little library, and starting reading-rooms; with the usual result, — that few of its weary, slow-brained servants could or did make any use of them. Then some one suggested that men too unaccustomed to mental work after daily labor, or too weary for it, might find a lift in lectures such as have long been given in England to workmen of their class: so Professor Martin, with the cordial assistance of Mr. Garratt, the president of the road, devised, with his colleagues, a course of four lectures on subjects which admit of clear demonstration, and which are well within the field of ordinary human experience. How skulls and backbones are made, How we move, On fermentation, Some curious kinds of locomotion, — are all topics which admit of popular treatment, moral-pointing wit, and clever *ad hominem* appeals to awaken the toil-deadened mind. On reading them over, we are not surprised that there were six hundred of the servants of this railway, men and their families, that found pleasure in their hearing.

This good work will, we may hope, give a fresh start to the system of lecturing in this country. We all have seen the rapid decline of the American lyceum lecture, once the most powerful agent of general culture in modern or perhaps all times. Those who have watched the debasements that have attended its decay — the parade of unsavory parsons, vaporing quacks, and offensive rhetoricians — have been driven to wish that this decay might speedily end in death. That part of the American world that profited by the old lyceum system has found its way beyond the stage in its development where such teaching could be of much value. So the platform had to merge itself in the stage, and become a place of exhibition, and not of instruction. Books in the old day were few and dear; libraries did not exist; but now, where any village that of old supported a lyceum has a public library, men and women do better to read a book by a master, rather than hear an hour's talk by any man, however masterful; for the chance is a thousand to one that the essence of any teacher cannot be had in an hour's talk.

But since those primeval days, when a New-England village filled a lecture-room with a keen-witted set of farmers and shopkeepers, the complexion of our American society has changed for the worse. A distinct class of laboring men — men who are ground in the mills and mines until they tend to become mere machines — has grown up in this country, and is increasing at the expense of the farmer and mechanic class. If our system of government has one danger greater than all others, it is to be found in the fact that culture slips by this class. Their habits of life fit them to be the prey of the demagogue; and in such wild outbreaks as the Pittsburg riots we see the natural results of their conditions.

The most important educational problem of our day comes to us from these people; and such essays towards its solution as these Baltimore lectures give us are very welcome, not for what they have really accomplished, but as a possible indication of other and better relations between great corporations and their people.

Gloze it as we may, it is clear that within our modern Commonwealths there has grown

up a set of local governments in the shape of corporations, which hold their employees with a sovereign hand. They are not to blame for the despotism they exercise: that is in the nature of things; nevertheless, this necessary power brings its measure of duties with it. If they will only see, that among those duties which they owe to their subjects is that of giving them help in escaping the evil consequences of their position as far as is consistent with their necessary labor, they will do much to secure their best interests in the future. Considered in a large way, there is no doubt that such efforts as this of President Garratt would prove so immediately profitable, that they could fairly find their way into the balance-sheet of a corporation. The good-will of the dependents of such a principality as a great railway is really a part of its assets; as an insurance against the portentous dangers of grave discontent, it is of inestimable value.

Let us hope that our great corporations will follow this good example, and that in time they will become as powerful agents of intellectual as they have been of economic progress.

THE WATCHMAKING INDUSTRY IN SWITZERLAND.

I HAVE taken advantage of a short stay in this country to learn something of the watchmaking industry. The importance of this branch of manufacture to Switzerland is familiar to all, but not every one has an idea of the national character which it assumes. Locle and Chaux-de-Fonds are two cities an hour's walk apart, containing together between 30,000 and 35,000 inhabitants, with whom watchmaking — or, rather, making the different parts of a watch — is almost the sole business. The business directory is classified into occupations so minute as cutting the figures on watch-faces. The catalogue of individuals or firms who make hands of watches contains, like our own directories, occasional notices of specialties in the manufacture of hands. Special schools of horology are established by the state, in order that nothing may be left undone to save the national supremacy, which has been so endangered by American competition. The result of this competition on the Swiss watch manufacture is a subject worthy of attention from all who are interested in accurate horology.

The general depression produced ten years ago by the competition of the machine-made watches of Waltham and Elgin is well known; but the statements of it were either somewhat exaggerated, or there has been a great recovery. It must be remembered that these Swiss watchmakers were not the unfortunate, half-starved paupers described by some of our American economists, but men, who, by hereditary skill and careful training, had acquired a remarkable proficiency in their art. I have been assured that the best workmen in some of the branches were able to earn as much as a hundred francs a day; and this in a country of most economical habits. Here was a wide margin for retrenchment when the storm came. It was, of course, necessary for the Swiss to cheapen their products; but policy and national pride also urged the better course of improving the quality of their work. Among us, twenty or thirty years ago, Swiss watches were noted for their cheapness rather than their excellence; and, when an American wanted the best kind of a time-keeper, he sent to London or Copenhagen. The Swiss saw that the best way to recover their lost advantage was to apply their skill in doing what machinery could not do, — making a finer finish and more delicate adjustments. In this they claim to have been so successful as to defy competition, having repeatedly won prizes at exhibitions where American watches and their own were placed on trial. How far this claim may be well founded I am unable to say; but the data for judging of the character of the improvement are fortunately at hand, in a state which readily admits of presentation. The observatory of Neuchâtel was established, and an able astronomer (Dr. Hirsch) placed in charge, for the especial benefit of the watchmakers. The best watches and chronometers, to the number of several hundred per year, are here tested, the results published, and prizes awarded to those which fulfil certain conditions. The principal data on which the judgment is based are, —

1. The average difference between the daily rate of the watch on one day and on the day following.

2. The changes of daily rate produced by changes of position. In the severer tests the watch is tried in four positions, — lying flat, suspended in the usual way, handle to the right, handle to the left. The large majority are tested only in the first two positions.

The mean results for some years, in the following table, show how great the improvement which has been made: —

Year.	Mean change of daily rate in a day.	Difference in two positions.
	Seconds.	Seconds.
1862	1.61	-
1863	1.28	-
1864	1.27	8.21
1865	0.88	6.18
1866	0.74	3.56
1867	0.66	3.57
1868	0.57	2.44

From 1868 the improvement, though well marked, is rather slow. The mean result for the three years, 1879–81, is, —

	Sec.
Mean difference between daily rates on two consecutive days	0.53
Difference of rate when flat and vertical	1.84
Sum of the variations in all four positions	8.23

It would be interesting to know how these numbers compare with the corresponding ones for American watches. But in no other country than Switzerland are the public interests so deeply involved that such data are officially published. We know that the Waltham watches, and probably those of all other American factories, are adjusted with the greatest care, to have, as nearly as possible, the same rate in different positions; but we do not know how near they approach precision, nor how they would stand the test after being a few months outside the factory.

After all, the practical question is not so much how good a watch is it possible to make, as how cheaply can you make a watch of the first class. One has long been able to get as good a watch as could be made from Frodsham or Jurgensen by paying from $300 to $500 for it. What the world has gained by the revolution is the ability to command a watch equal, or but little inferior, to the best, at less than half the old price. Here seem to lie, at the present time, the best grounds for the claim of superiority on the part of the Swiss. I am informed that the best anchor escapement watches, such as those whose performance is given in the preceding table, are sold in gold cases for $120, manufacturer's price: this for watches that cannot be exceeded in quality. Can any American company do as well as this?

The Swiss manufacturers have not been slow to avail themselves of the American system of machinery, but I doubt whether they have been able to bring the system to the perfection which it has attained at Waltham. There are two or three great factories on the American plan; but I have not had an opportunity to visit any of them. Owing to the want of steam and water power, and the habit of having the operatives work at home, only such machinery as each man can manage for himself is available at the great centres. Such is the case at Locle and Chaux-de-Fonds. That this is a great disadvantage can hardly be doubted.

A point which the official Swiss tests do not sufficiently consider is the isochronism of the balance under changes of pressure. The Swiss follow the American plan of dispensing with the fusee and chain, and winding up the mainspring from the centre. A great advantage is thus gained in simplicity of structure and freedom from accident; the frequent breaking of the chain, in former times, having been the greatest source of annoyance to the owners of watches. But, if great accuracy of running is aimed at, we now have the disadvantage that the spring acts with greater force when the watch is first wound up, and that the pressure continually diminishes as the watch runs down. The change of rate between day and night thus arising may exceed the variations from all other causes combined. To avoid this difficulty, each balance and hair-spring has to be adjusted by repeated trial; and the perfection of the adjustment should, in all cases, be one of the subjects of any scientific test. This gives rise to an ulterior question, on which I am not quite satisfied. One carries the most perfectly adjusted watch in his pocket for two or three years, and then has to hand it to a watchmaker to be cleaned and oiled. Will the watchmaker be able to put it together again, in perfect adjustment, without spending on it the same time, trouble, and skill which was originally spent by the maker? If this question is to be answered in the negative, it will practically be a waste of labor to perfect the pocket-watch further without re-introducing the fusee and chain. But in these times, when every one who wants accurate time can get it without trouble, an error of a few seconds a day in the running of a watch will be a less evil than the liability to accident from the breaking of the chain. S. N.

Neuchâtel, March 12, 1883.

THE TAGALS OF LUZON.

THE present natives of the Philippines are generally believed to be of Malay origin, and to have been carried there from the Pacific islands involuntarily by the monsoons, or purposely by migration. They have the same form, character, and habits, as the more barbarous branches of the same race, though of more agreeable and manly features. Those of the southern islands look more like Malays than do the Tagals of Luzon, who are more or

less mixed with Chinese, Japanese, and Negritos. In some islands the Chinese, in others the Japanese, type prevails, according to the proximity of these countries.

They are finely formed, of good stature, copper-colored, with abundant straight, coarse,

TAGALS OF THE PHILIPPINES.

black hair, without beard; head well shaped, but flattened behind; forehead moderate, cheeks prominent, nose flattish, face long, and chin narrow; mouth large, with thick lips, strong teeth, and powerful jaws; chest wide; limbs and feet small, though the great toe is abnormally developed, and almost as prehensile as a thumb; the joints very supple.

Nature supplies the Tagal with rice, fruit, roots, and fish; and his skin is his principal garment. He has, therefore, little inducement to work, and, as a rule, does not, unless from necessity, or to buy some gewgaw; then relapsing into his *dolce far niente* under the palms. Their family ties are close, but peculiar in many of their ideas of what we should call propriety. They are trusty servants, good soldiers and sailors, fertile in expedients, using with much skill their natural advantages. They think little of death, beyond a splendid funeral, and, though nominally Catholics, believe in secret in the superstitions of their race. They chew betel, smoke immoderately, and are very fond of cock-fights and lotteries. Their houses are made of bamboo and canes, thatched with the leaves of the nipa palm, and supported on posts. No nails or tools are required for their construction. All the Tagal needs is his *bolo*, or knife; for the materials are growing all around. I know of no race more independent of the industrial arts. His *bolo* is his only essential implement. His spoon, bowl, and basket he finds in the shell of the cocoanut; his basin, plate, and umbrella, in the leaf of the banana; most of his domestic utensils, in the bamboo; his house, mat, hat, in the various palms. His fruit requires no cooking, and his fish and rice only the simplest. If ever there were a child of nature, the Tagal is one.

The Tagals are noted for their skill in weaving the vegetable fibres of their country, and especially those of the pineapple, hemp, bamboo, palms, and reeds. *Jusi* is raw silk; *seda*, spun silk; hemp, *abaca*, *lupis*, and *sinamay*, which are variously combined in the gauze-like tissues for which these islands are famous. How they make such exquisite fabrics with the rude processes at their command is one of the puzzles which the traveller often meets among semi-civilized peoples.

COSTUME OF TAGAL WOMEN.

The Tagals are the most numerous, best known, least barbaric, and most industrious of the races. They speak a dialect of their own, — the mother-tongue of the others, — and number about 1,500,000. The Visayas of the southern islands are possibly more in number. The islands belong to Spain, and, during her three centuries of occupation, have been very poorly developed. SAMUEL KNEELAND.

THE SOLAR ECLIPSE OF MAY 6.

THE members of the expedition for observing the total solar eclipse of May 6, who left New York on March 2, arrived in Callao, Peru, on March 20. At that port they were received by the U. S. vessel Hartford, and sailed on the 22d for Caroline Island, expecting to make the journey in about twenty-five days. Ample time is thus secured for the preliminary work for the contemplated observations.

It is not known yet whether the party will establish themselves upon Caroline or Flint Island. Preference is given to the former, on account of its larger size, and it will be chosen unless it is found that the French astronomers have already located there, in which case the Americans will select Flint Island, that both points may be occupied. The *L'Eclaireur*, the man-of-war which is to convey the French astronomers from Panama, was not in that port when the Americans passed through there.

The two English members of the party, Messrs. H. A. Lawrance and C. Ray Woods, joined the expedition at Panama. They are sent out by the Royal society and the Committee of solar physics, of which Messrs. Lockyer, Stewart, and Stokes are the leading members, and made important observations of the eclipse of last May. These gentlemen come from South Kensington, and have been engaged in spectroscopic work with Mr. Lockyer.

The plans of the party show that spectroscopic observations will be the principal work attempted. An outline of these plans will be of interest.

A spectroscope with a large prism, attached to a 6¼-inch telescope, will be used by Dr. Hastings for studying the corona, especially the outer corona. During partial phase the chromosphere will be examined, a grating being substituted for the prism. Mr. Rockwell will observe with a grating spectroscope attached to a $4\frac{1}{10}$-inch telescope, and will note the relative lengths of lines reversed just before totality within a small region of the spectrum. Probably just after this, the grating will be exchanged for a single 60° prism, and an examination made of the limits to which the line 1474 K can be traced. A prismatic spectroscope, which consists of a large 30° prism placed before the objective of a 2½-inch telescope, will be used by Mr. Upton for observing the relative heights and brightness of the hydrogen group, and of other portions of the spectrum. Mr. Brown will use an integrating spectroscope for observing the lines which appear during totality, and the changes which they undergo.

Mr. Lawrance has planned an equatorial stand upon which is mounted a 6-inch objective, having at its focus a grating spectroscope with cameras on each side, for photographing the spectra of the first and second orders. On the same stand is a 6-inch photographic lens, in the focus of which is a spectroscope of low dispersion, armed with a camera. These three cameras will be used to photograph the flash just before and after totality, in order to confirm, if possible, by photography, Mr. Lockyer's eye-observations of last year. He observed the short, bright, chromospheric lines ten minutes before totality began, and, just before totality, the lines which are usually thickened in sunspots, extending as faint lines to a much greater elevation than those of the protuberances. Mr. Woods will employ a siderostat to throw a beam of light upon four instruments, — integrating, analyzing, and prismatic spectroscopes, and a Rowland grating. The photographic plate of the integrating spectroscope is very long, and will be driven by clock-work, in order that, as the portion of the plate illuminated at any given instant is small, the integrated effects that have hitherto been photographed may be differentiated if possible. The grating is provided with cameras on each side, — one to photograph the F region; the other, that more refrangible than H. The prismatic camera was used with great success in Egypt last year. It integrates the light from all parts of the corona; and it is hoped that all the rays, from the violet to the ultra-red, will be photographed. The analyzing spectroscope was also used with good result in Egypt. The plates will be 'red-end' ones, in order to take in all the rays of the spectrum.

In addition to the spectroscopic work, other important observations are planned. Professor Holden will search for intra-Mercurial planets with a 6-inch telescope, and Mr. Preston will use a Savart polariscope attached to a 4-inch or a 2½-inch telescope. Two photoheliographs will be used for photographing the inner and outer details of the corona, under the management of Mr. Lawrance. Observations of solar radiation, of meteorological phenomena, and of the times of contact, will also be made.

After the eclipse, the party is to be conveyed to Honolulu by the Hartford, from which point they will reach San Francisco by the Pacific mail line of steamers. Should there be no delay, intelligence of the results of the expedition may be expected by the middle of June.

W. U.

Callao, Peru, March 22, 1883.

THE FLORIDA EXPEDITION TO OBSERVE THE TRANSIT OF VENUS.[1]

In selecting the four stations in the northern hemisphere from which to observe the transit of Venus on Dec. 6, 1882, the probable weather at that season, together with the geographical position of the various points considered, were the principal terms in the problem. It was desirable to find points where good weather would be likely to prevail, and where all the contacts, both at ingress and egress, could be seen. Considerable advantage being gained by increasing the distance between the southern and northern stations, those in the United States were chosen as far north as possible, and fulfil the first two conditions.

With these views, the transit of Venus commission selected a point near Fort Selden, New Mexico, San Antonio, Tex., Cedar Keys, Fla., and the naval observatory at Washington. The three southern stations, all between 29° and 33° N. Lat., presented marked differences in their surroundings. The station in New Mexico was about 5,000 feet above the sea, with the air dry and cool. San Antonio has an elevation of about 600 feet, with a dry, warm climate. Cedar Keys is barely above the water of the Gulf of Mexico. In November the weather was hot and comparatively dry, with increasing dampness as the nights became cooler, about the first of December. Washington was chosen because a complete set of apparatus was in working order at the observatory.

The party under my direction was assigned to Cedar Keys, which point we reached Nov. 4. The name Cedar Keys was formerly applied to the whole group of keys between the mouths of the Suwannee and Withlacoochee rivers, but is now used to designate an active business town on Way Key, the largest of the group. This town sprang into existence after the close of the war, and is chiefly interested in the lumber, shipping, and fishing interests, while it is the shipping-point for all the cedar used by the Faber and the Eagle pencil companies, in the manufacture of pencils, etc.

A site for the observing station was selected in a small park at the eastern end of the town; and the construction of the buildings and mounting of the instruments were pushed forward as fast as possible. The so-called soil of Way Key is simply a mass of white sand; and in the grounds of the station, where a pipe well, with a pump, was sunk, the sand existed at a depth of at least fifteen feet.

[1] Abstract of a paper read by Prof. J. R. Eastman before the Washington philosophical society, March 24, 1883.

The buildings for the protection of the instruments were a transit-house, photograph-house, and the building to contain the equatorial telescope; while a small storehouse was built to protect the stores, etc. The principal instruments were a portable transit, a 5-inch equatorial telescope, and a photoheliograph. The first two require no description. The photoheliograph consists of an objective of 5 inches aperture and about 40 feet focus, a heliostat for throwing the sun's rays on the objective, and a plate-holder at the focus of the objective. The objective and the mirror of the heliostat are mounted on the northern pier at northern stations, and the plate-holder is mounted on a similar pier in the photograph-house. The accessory apparatus consists of a measuring-rod, permanently mounted, for accurately measuring the distance from the objective to the photograph-plate; a movable slide, with a slit of adjustable width for exposing the plates; and a circuit connecting with the chronograph in the transit-house, so arranged, that when the exposing-slide is moved to expose the plate, and when the centre of the slit is opposite the centre of the plate-holder, the circuit is broken, and the record made on the chronograph. A black disk is painted on the north side of the slide, and so placed, that when the slide is at rest at one end of its course, and the image of the sun is adjusted concentric with this disk, it will fall on the centre of the plate-holder when the slide is moved. When all the adjustments are made, the exposing of the plates is quite a simple matter. The image of the sun is thrown by the heliostat upon the black disk and centred, the sensitive plate is fixed in the plate-holder, the operator moves the exposing-slide, and the time of exposure is recorded on the chronograph. The plate is now ready to be developed; and here the ablest photographer has an ample field for the exercise of all his skill. The first photographs were made Nov. 23.

The weather was excellent till the last of November, when we had our first norther and a frost, followed by rain and another norther; but Dec. 4 and 5 were clear and mild. At sunset on the 5th, a low bank of clouds was spread along the south-western horizon; but the sky was clear at midnight. On the morning of the 6th, the southern and eastern sky was nearly covered with light cirrus and stratus clouds, with an upper south-west wind, while the surface wind was from the east. All the apparatus was examined, and found to be in good order; and the astronomers went to the equatorial telescope to observe the first contact.

For observing contacts I used an eye-piece magnifying 216 diameters, attached to a Herschel solar prism, and a sliding-shade glass with a density varying uniformly from end to end. The limb of the sun was remarkably steady. The assistant astronomer, Lieut. J. A. Norris, U.S.N., was to take the time of my signals from a mean-time chronometer, while with an observing-key I was to make a record on the chronograph as a check.

About forty seconds before the computed time of first contact, a narrow stratus cloud passed upon the south-eastern edge of the sun, and shut out all the light. The cloud remained about three minutes; and, when it passed off, the notch in the sun's limb was plainly marked. Two photographs were taken to test the apparatus and the plates; and then the time before *second* contact was devoted to an examination of the limbs of Venus and the sun. Both were perfectly steady. In observations of the sun for the last twenty years I never saw it better. At about thirteen minutes after first contact, the outline of the entire disk of Venus could be seen, and seemed perfectly circular. About two minutes later, a faint, thin rim of yellowish light appeared around the limb yet outside the sun. This rim was at first broadest near the sun's limb, but soon the width of the light became uniform throughout. The light was wholly exterior to the limb of Venus; i.e., the black limb of Venus on the sun, and the dark limb outside, formed a perfectly circular disk with the rim of light, or halo, outside the portion off the sun. As the time of second contact approached, Lieut. Norris again took up his station at the chronometer. As the limbs neared geometrical contact, the cusps of sunlight began to close around Venus more rapidly; and the perfect definition of the limbs, and the steady, deliberate, but uniformly increasing motion of the cusps, convinced me instantly that the phenomena attending the contact would be far more simple than I had ever imagined. I had only to look steadily, to see the cusps steadily but rapidly extend themselves into the thinnest visible thread of light around the following limb of Venus, and remain there without a tremor or pulsation. At the moment the cusps joined I gave the signal, and also made the record on the chronograph. Still keeping my eye at the telescope, I saw nothing to note save the gradually increasing line of light between the limbs of the two bodies. The disk of Venus on the sun was black. All the apparatus connected with the photographic work was again examined; and, at about ten minutes after second contact, each member of the party was at his station. Lieut. Norris, who had charge of the chronograph and the heliostat, was stationed at the latter instrument to see that at certain intervals the motion of the heliostat was corrected, and the sun's image thrown in the proper direction. In the photograph-house, the assistant photographer, Mr. G. Maxwell, took each plate from the box, placed it in the plate-holder, called its number, and, after exposure, returned the plate to the proper box. My own share of the work was to record the number of the plate, move the exposing-slide, record the time of exposure of each plate from a chronometer as a check on the chronograph record and as a means of identification, and communicate with Lieut. Norris by a system of signals on the measuring-rod. The chief photographer, Mr. G. Prince, developed the last plate exposed until nearly all the clouds had disappeared, carefully watched all the photographic manipulations, advised in regard to the length of exposure, etc., and prepared and developed, with occasional aid from Mr. Maxwell, all the wet plates used during the day. After the clouds disappeared, measures of the diameter of Venus were made with a double-image micrometer attached to the 5-inch telescope; and then the photographic work was resumed more leisurely. It was intended to use dry plates for all the work; but difficulty in drying the first 150 which were coated, led me to the determination to coat anew only 150 plates, and leave the others to be used as wet plates if the dry plates should unexpectedly fail at the last hour. After eleven o'clock A.M., the clouds disappeared; and, finding we had plenty of time on our hands, we exposed *six* wet plates after each group of twelve dry plates.

At about ten minutes before *third* contact we had exposed 150 dry plates and 30 wet ones. The majority of the dry plates were exposed with a slit 1.5 inches wide, while with the wet plates the width was three-eighths of an inch. On going to the telescope to observe the last contacts, I found the limbs of Venus and the sun as steady as in the morning; and, though there was now some haze over the sun, it did no harm. The third contact was observed with great accuracy, nothing occurring to obstruct or complicate the very simple and definite phenomena which was in the reverse order of that seen at second contact. The rim of light appeared around Venus as soon as the limb was visible beyond the sun, and was seen for nearly ten minutes. The complete outline of Venus was visible for two

minutes later. No phenomena worthy of note were seen between third and fourth contacts. The lapping of the limb of Venus over that of the sun gradually but steadily decreased, until the final separation was observed with great accuracy for such a phenomenon. Soon after the last contact, the entire apparatus was again carefully examined, and the necessary observations made to determine the errors of the chronometers. All the measures were made, also, for determining the exact position of the photoheliograph.

The dry plates were developed in a few days; and 146 dry plates and 30 wet ones were sent to Washington, all of which can be easily measured. Two dry plates were exposed in the forenoon, when the clouds were too dense, and no images were obtained; and two others were accidentally broken.

In the observations of interior contacts there was no trace of any tremor or fluctuation of the light in the cusps, as they closed around the limb of Venus; and it is almost needless to say, that there was no trace of a shadow or a black drop or ligament between the limbs at second and third contacts. The probable error of the second and third contacts was estimated at 0.3s.; for fourth contact, 0.5s.

Observers of transits of Venus and Mercury have written so much in regard to the obstacles encountered from the apparition of the shadow or black drop between the limbs of the two bodies at *second* and *third* contacts, and so full has been the testimony in favor of the existence, and the almost necessary occurrence, of this phenomena, that, at the transit of Mercury in 1878, many observers claimed, as evidence of their skill, that they *did* see it, while others less fortunate apologized for *not* seeing it. Observers of the black drop were so generally confined to those with imperfect apparatus, or to those unaccustomed to observations of the sun's limb or disk, that the true nature of the obstacle was pretty well understood before it was carefully investigated. It is now quite well settled, that the 'black drop' is due to bad eyes, imperfect apparatus, or the inexperience of the observer. With good eyes and proper apparatus, a good observer never should see the black drop: for, when it is seen, there is something wrong; it is a spurious phenomenon.

A TELEPHONIC TIME-TRANSMITTER.

AMONG the various methods of distributing time, the telephone affords one commendable for its simplicity. Its use for this purpose does not seem to be generally appreciated, and I know of only one contrivance adapted to it other than the one to be described. This one can be called a time-transmitter from its resemblance in appearance and action to the Blake transmitter in ordinary telephones. It is the invention of Mr. C. W. Ruehle of Detroit, and has been in use at the observatory at Ann Arbor for about six months. Its behavior is in every way satisfactory.

Its general character can be seen from the accompanying figures. Fig. 1 is the face view of the transmitter. At *a*, *a* are the binding-

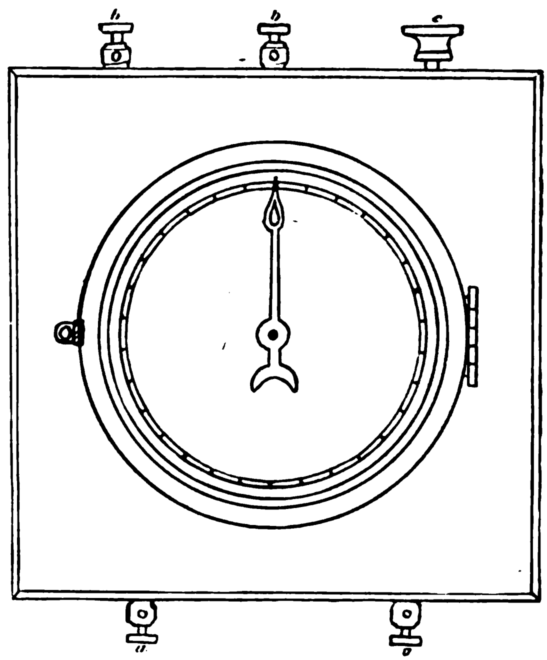


FIG. 1.

posts for the wires from the battery; *b*, *b*, those for the wires of the telephonic circuit. Between the latter is a switch, not represented in the drawing, which enables the operator to cut out the telephone circuit when any thing goes wrong. *c* is a button, by pressing which the instrument can be set going. When started, it runs for two and one-half minutes, during which time the hand in the centre completes a revolution. At the end of that time it stops, and can be started again only by pressing the button.

In Fig. 2 we have a view of the interior. We have here ordinary clock-work, with the addition of a Ruhmkorff coil at *d*, the unlocking part *e*, a circuit-breaker at *f*, and an intermitting-wheel *g*. This wheel moves to the right.

As it turns, the radiating bars on it are brought to a vertical position one after the other; and, while passing this position, they raise the lever suspended above, and, by the action of the pin at its end, keep the circuit open. They are so placed and gauged that they hold the circuit open from 55 to 60 seconds of the first, and then of the second minute.

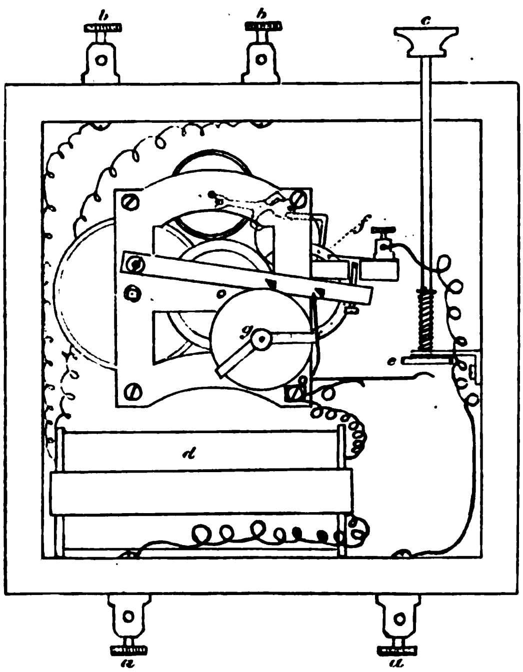


FIG. 2.

Each break in the primary circuit causes a distinctly audible sound in the ear-telephone. This sound is so loud that I have sometimes heard it across the room. As the circuit is broken each second for the first fifty-five seconds of each full minute, and for the full thirty of the last half-minute, the time-transmitter gives a series of seconds signals easily received at any telephone in connection with it. The intermission of five seconds at the end of each full minute serves to notify the receiver that the next minute is about to begin, and thus saves him the trouble of counting.

In using the time-transmitter, the person who desires the time calls me up by telephone, and I start the transmitter at the beginning of some minute by his time. The correspondents are usually jewellers, and do not need to be told the minute at which the transmitter began. If they do need the minute, it can be given them verbally by the Blake transmitter. The succession of beats and intermissions gives the receiver four opportunities for comparison; viz., the beginning of the first, second, and third minute, and the end of two minutes and a half.

An important feature of this method is its capacity for transmitting time to several or many persons simultaneously. In order to test this, Manager Keech of this place obligingly called up all the exchanges connected with us. Some did not respond; but those who did — a dozen or fifteen in number, and distant in all directions from ten to seventy-five miles from us — all heard the beats of the transmitter distinctly, except at Port Huron. From this and some other tests, I concluded, that, by this method, the time could be received by at least twenty-five telephones simultaneously.

M. W. HARRINGTON.

PARENTAL INSTINCT AS A FACTOR IN THE EVOLUTION OF SPECIES.

IN a recent lecture at the Sheffield scientific school, New Haven, the writer called attention to the lack of maternal care as one of the probable causes, though usually overlooked, of the extinction of many of the large and powerful reptiles of the mesozoic age, and of the large mammals of the tertiary. The very small size of the brain and its low organization, in these early animals, are now well known, and we are justified in believing that their intelligence or sagacity was correspondingly low. They were doubtless stupid and sluggish in their habits, but probably had great powers of active and passive resistance against correspondingly stupid carnivorous species. But, unless the helpless young were protected by their parents, they would quickly have been destroyed; and such species might, in this way, have been rapidly exterminated whenever they came in contact with new forms of carnivorous animals, having the instinct to destroy the new-born young of mammals, and the eggs and young of oviparous reptiles.

Thus it would have come about, that the more intelligent forms, by the development of the parental instinct for the active protection of their young against their enemies, would have survived longest, and therefore would have transmitted this instinct, with other correlated cerebral developments, to their descendants. This mode of natural selection must always have been a very active one, wherever carnivorous mammals, birds, and reptiles, have existed in contact with herbivorous species.

Moreover, such Carnivora, among modern species, will also devour the eggs and young of other Carnivora. Therefore the development of equally strong parental instincts in the Carnivora themselves would have come about in the same way. It is evident, that, in this manner, carnivorous animals of comparatively small size may have been the means of exterminating the largest and most powerful beasts and reptiles.

Among nearly all of the existing mammals and birds, the parental instinct is very remarkably developed in one or both sexes, usually more so in the female. Many species, now abundant, would soon become extinct if the parents did not have remarkable sagacity in protecting their young against numerous enemies. Many reptiles, fishes, insects, and still lower forms, also show wonderful maternal instincts. We cannot suppose that their ancient allies had these instincts in the same way, nor to the same extent. In many cases the enemies to be protected against are of comparatively modern origin. New modes of parental protection must, therefore, have been developed or acquired as new enemies appeared. The ways in which different species protect their young are exceedingly varied, as all naturalists know; and many areas wonderful as any habits known among the lower animals.

The development of the powerful parental instinct for the protection and care of the young, in the earliest races of man, must have been of vital importance in man's struggle for existence in his primitive and comparatively helpless condition.

In fact, it is evident, that without this strong impulse, and the intelligence necessary to make it effective, neither man, nor any of the species of mammals belonging to the higher orders, could have existed, even for a short period.

Possibly the variations in the degree of development of the parental care, in different races of man, may be connected with the increase of some races and the extinction or decline of others. A. E. Verrill.

LAKES AND VALLEYS IN NORTH-EASTERN PENNSYLVANIA.

H. D. Rogers, many years ago, pointed out the connection between the lakes and the northern drift in Pennsylvania. In a recent report of the second geological survey,[1] Mr. White gives fuller information on this interesting question, and shows that the numerous ponds north of the Delaware Water-gap (forty-two are enumerated) are generally held in either drift-barrier or drift-enclosure basins, though the depth of some of them seems partly dependent on local erosion in soft shale. The largest is about two square miles in area, and nearly all are less than forty feet in depth. Their shape is generally round or oval; but Long Lake, a narrow expansion of Tunkhannock Creek, three miles long, is an exception to the rule; and, unlike the others, it stands just outside the so-called 'terminal moraine,' or margin of the glaciated area. Glacial action is not regarded as having effected great destructive changes in the pre-existing topography, except in the way of 'pushing or disrupting' rocks that were divided into blocks by joints. The corniferous limestone, especially, has suffered in this way; and its great bowlders, 'many of them as large as a good-sized house,' are strewn beyond its outcrop over a scored and polished surface of cauda-galli grit. It would be interesting to learn if such corniferous bowlders are limited to the glaciated district, and do not occur farther south as a result of simple weathering. All the larger valleys of this region contain modified drift, on which the streams flow without reaching the rocky bottom. In the Delaware and Lehigh valleys, this drift extends far beyond the limits of glacial action; but in the Schuylkill valley, which heads outside of the glaciated area, it is absent altogether (p. xvii.). At and above the Delaware Water-gap, the rocky channel is filled with drift to a depth of probably one hundred feet. All the line of outcrop of the Marcellus shale, from north of Rondout, N.Y., past Port Jervis, where the Delaware joins and flows along it, even beyond Stroudsburg, a distance of ninety miles, is an old, wide, deep valley, buried in stratified drift; but on passing out of the glaciated area, just south of Sciota, some distance after the Delaware turns southward through its gap, the same weak shale is occupied by a valley less than a tenth of its former width. It is therefore suggested that this buried valley was cut by streams under the ice of glacial times.

Narrow post-glacial channels of moderate length, cut in the rock by streams turned from their open pre-glacial valleys by drift-obstruction, are found at several points. The drift-filling of the old Sawkill is as much as three hundred feet deep; and the falls on its new channel are a result and mark of its recent adoption. Raymondskill Falls have the same cause. The Wallenpaupack takes a short cut of two miles, instead of following its old path of four miles, to the Lackawaxen, and, on its new course, has eroded a gorge seventy-five feet deep, ending in falls with a total descent of two hundred and sixty feet in a mile. Above the gorge, the stream meanders for ten miles over a broad, marshy flat, falling only half a foot to a mile, — the final stage of a lake that must have existed in the obstructed valley till the cutting of the gorge drained it. It is very plausibly suggested that all the cascades of this district "owe their origin to a similar diversion of their streams by the drift-dams thrown across their pre-glacial channels;" and we believe that this cause of gorge, ravine and cascade has a very general application in glaciated countries.

The greater part of the report following these introductory pages is devoted to a detailed description of the geological formations of the district.

Mr. Chance's surveys of the Delaware and Lehigh Water-gaps, in the same report, include fine illustration of these notable cross-valleys in contour-line maps and vertical sections; but their description is chiefly geological. It may be noted, that the disloca-

[1] G. 6. Geology of Pike and Monroe Counties, by I. C. White; Special surveys of the Delaware and Lehigh Water-gaps, by H. M. Chance. Harrisburg, 1882.

tion that determines the position of the Delaware Gap is regarded as warping or gentle transverse folding, rather than as a fault, as it has generally been considered (p. 338). The map of glacial striae included in this volume is constructed by Professor Lesley, from Mr. White's observations. It shows a general trend of striae S. 20 to 30° W., but with significant deflections on approaching Kittatinny and Pocono Mountains. A perched bowlder was found on the top of High Knob, 2,010 feet above tide, and glacial scratches were observed on Pocono Mountain at an elevation of 2,150 feet. W. M. DAVIS.

AN APPARENTLY NEW ANIMAL TYPE.

PROF. F. E. SCHULZE, who already ranks so high among zoölogists, has now another claim to distinction, through the discovery of an animal quite different from any thing hitherto known.

The animal was observed in the salt-water aquaria of the zoölogical institute at Graz. It is a thin plate, about 0.02 mm. thick, and only a few millimetres in diameter. It constantly changes its form. It is translucent, and grayish white in color. At rest it is rounded in outline, but may draw itself out into a long thread, which may so curl and twist, that it recalls a Persian or a Turkish letter. The movements are usually so slow as to be barely perceptible, as the animals creep along upon their under surfaces.

Microscopic examination shows that the whole surface of the body is ciliated. Close under the upper surface is a layer of highly refractile balls from 5 to 8 μ. in diameter, and distributed pretty evenly. Besides these, there are other balls nearer the under surface, which seem to be essentially different from those first mentioned. There is no indication of internal organs, nor of only bilateral or radiate symmetry: the organism is uniaxial. Schulze names it the ciliated plate, Trichoplax, with the specific name adhaerens, because it clings so closely to the surface on which it is moving.

Such an organism one would expect to find related to the protozoa; far from it, for two different epithelial layers of cells form its upper and lower surfaces, and contain between them a fully developed layer of connective tissue. The upper epithelium is composed of large, flattened, polygonal cells: the lower epithelium, on the contrary, is composed of cylinder-cells, whose outer ends form a mosaic of small polygons, but whose inner ends terminate in processes that are lost in the connective tissue. This last, forming the middle layer of the body, consists of spindle-shaped and branching nucleated cells, which are probably contractile, and are embedded in a hyaline basal substance. The balls above mentioned are contained in large cells. There are, then, three layers, which from their relations would naturally be compared with the ectoderm, mesoderm, and endoderm of other metazoa; but the justification of this comparison must await a knowledge of the development of the organism.

Professor Schulze speculates as to the relationship of this creature, but finds it impossible to assign it to any known class. Although it has been watched for a year, no sign of metamorphosis or of reproduction has been observed; but Schulze thinks it possible that it may have multiplied in the autumn by division.

It seems to me that the animal bears a strong resemblance to a sponge larva. The surmise that it is the young of a porifer may be a useful hint for the further study of this singular form.

The original article is published in the *Zoolog. anzeiger*, no. 132. CHARLES S. MINOT.

THE COLOR-PREFERENCES OF THE HIVE-BEE.

DR. HERMANN MÜLLER, who does not accept the results of Sir John Lubbock's studies of this subject as very conclusive, has himself made a considerable number of observations in the same line (*Kosmos* for Jan.). Though too few to serve as a basis for very broad generalization, they give, so far as they go, a strong degree of proof to several points previously theoretical.

The colors experimented upon were not artificial, but actual floral colors, prepared for use by gumming fresh petals between two ordinary microscope-slides, care being taken that no protruding parts were left, and that the margin was sealed with gum-water, to prevent the possibility of any odor from the petals influencing the bees in their choice.

The bees to be observed were at first accustomed to visit uncolored slides, smeared with honey, exposed close by their hive, and gradually removed, in the course of several days, to a distance of twenty-six metres, where they were replaced by two slides of the colors to be compared, similarly smeared, and placed one decimetre apart. Each bee was marked on its back with an oil-color, by which it was recognized on its different visits. It was found later, that bees from distant hives, if caught on flowers a few steps from the place of observation, and transferred to the honeyed slides under a tumbler that had been sweetened in the same way, usually returned regularly.

In the different observations a number of marked bees were employed, both as a means of economizing time, and to compensate for the somewhat different preferences of individual insects. To eliminate the influence of location, the positions of the slides under observation were changed from time to time.

The general results reached are as follows: —

Leaf-green is less attractive to bees than the colors usually found in flowers adapted to pollination by them.

The colors of these, which may be conveniently called bee-flowers, are, without exception, preferred to fulgent colors, like the yellow of buttercups and the scarlet of some poppies, which usually occur in flowers open to a mixed circle of visitors, or adapted to humming-birds. The extent of their choice in each case may be seen from the annexed table; the figures indicating the relative number of visits, on a basis of 1,000 to each bee-flower color. (Table I.)

Fulgent colors are less attractive to bees than the neutral tint which precedes them in the development of the flower.

Bright yellow is less distasteful than other brilliant colors, but it is least acceptable of the colors found in bee-flowers. (Table II.)

Yellowish white and white are at least as attractive to Apis as many shades of purple, but less so than blue and violet. (Table III.)

Blue is preferred to the red of bee-flowers, or is at least equally acceptable, in the shades tested. Pure deep blue is even more attractive than violet. (Table IV.)

With the exception of blue, violet is more attractive than other colors experimented with. (Table V.)

Red, in the shades found in bee-flowers, constantly surpasses only yellow in its attractiveness for the hive-bee. It is equalled or surpassed by all other colors used for comparison. (Table VI.)

TABLE I.

Fulgent colors.	Bee-flower colors.	
Bright yellow (Ranunculus)	Honey-yellow (Diervilla)	615 : 1000.
" " "	White (Calystegia sepium)	437 : 1000.
" orange (Calendula)	Rose (Rosa centifolia)	310 : 1000.
" " (Esscholtzia crocea)	" " "	338 : 1000.
Red (Tropaeolum)	Violet (Viola tricolor)	362 : 1000.
Scarlet.	*Rose-color.*	
(a) Papaver rhoeas	Rosa centifolia	164 : 1000.
(b) Canna	" "	472 : 1000.
(c) Pelargonium	" "	530 : 1000.
Scarlet (Papaver rhoeas)	Pink-red (Dianthus armeria)	493 : 1000.
" " "	Blue (Centaurea cyanus)	167 : 1000.

TABLE II.

Yellow of bee-flowers.	Other colors of bee-flowers.	
Yellow (Potentilla anserina)	Purple (Trifolium pratense)	1000 : 1476.
	{ at first	1000 : 2250.
	{ later	1000 : 1000.
Golden yellow (Viola tricolor)	Yellowish white (Viola tricolor)	1000 : 1971.
Deep yellow (Oenothera glauca)	Indigo-blue (Aconitum napellus)	1000 : 2000.
Yellow (Helianthus annuus)	Pink-red (Silene armeria)	1000 : 2741.
Golden yellow (Viola tricolor)	Violet (Viola tricolor)	1000 : 3250.
Chrome-yellow (Paper)	Cobalt-blue (Paper)	1000 : 3636.

TABLE III.

Yellowish white and pure white.	Other colors of bee-flowers.	
Yellowish white (Viola tricolor)	Golden yellow (Viola tricolor)	1000 : 507.
White (Lathyrus odoratus)	Dark purple (Lathyrus odoratus)	1000 : 757.
Yellowish white (Lamium album)	Purple (Lamium maculatum)	1000 : 942.
" " (Viola tricolor)	Blue (Viola tricolor)	1000 : 1214.
" " " "	" " "	1000 : 1388.
White (Paper)	Sky-blue (Borago officinalis)	1000 : 1777.
Yellowish white (Viola tricolor)	Violet (Viola tricolor)	1000 : 2181.

TABLE IV.

Blue.	Other colors of bee-flowers.	
Cobalt-blue	Chrome-yellow	1000 : 275.
Indigo (Aconitum napellus)	Yellow (Oenothera glauca)	1000 : 500.
Violet (Geranium pratense)	Impure dark purple (Symphytum officinale)	1000 : 541.
Sky-blue (Borago officinalis)	White (Paper)	1000 : 562.
Pansy-blue (Viola tricolor)	Yellowish white (Viola tricolor)	1000 : 720.
Deep pansy-blue	Violet (Viola tricolor)	1000 : 700.
" " "	" " "	1000 : 826.
Sky-blue (Borago officinalis)	Bright purple (Geranium sanguineum)	1000 : 800.
" " "	Violet (Viola tricolor)	1000 : 877.
" (Echium)	Rose-color (Echium)	1000 : 947.
" (Borago officinalis)	" " (Rosa centifolia)	1000 : 1000.
Corn-flower blue (Centaurea cyanus)	Purple (Rosa)	1000 : 1000.
Violet-blue (Lathyrus odoratus)	Dark purple (Lathyrus odoratus)	1000 : 1000.
Pansy-blue, with some transmitted yellow	Pansy-violet	1000 : 1243.

TABLE V.

Violet.	Other floral colors.	
(Viola tricolor)	Golden yellow (Viola tricolor)	1000 : 308.
" "	Yellowish white (Viola tricolor)	1000 : 458.
" "	Purple (Rosa)	1000 : 698.
" "	Blue, with some transmitted yellow (Viola tricolor)	1000 : 804.
" "	Sky-blue (Borago officinalis)	1000 : 1140.
" "	Deep pansy-blue (Viola tricolor)	1000 : 1209.
" "	" " " " "	1000 : 1428.

TABLE VI.

Red of bee-flowers.	Other colors of bee-flowers.	
Pink-red (Silene armeria)	Yellow (Helianthus annuus)	1000 : 365.
Purple (Trifolium pratense)	" (Potentilla anserina)	1000 : 677.
Pure purple (Rosa)	Corn-flower blue (Centaurea cyanus)	1000 : 1000.
Dark purple (Lathyrus odoratus)	Violet-blue (Lathyrus odoratus)	1000 : 1000.
Rose-color (Rosa centifolia)	Sky-blue (Borago)	1000 : 1000.
" (Echium)	" (Echium)	1000 : 1055.
Purple (Lanium maculatum)	Yellowish white (Lanium album)	1000 : 1061.
Bright purple (Geranium sanguineum)	Sky-blue (Borago)	1000 : 1256.
Dark " (Lathyrus odoratus)	White (Lathyrus odoratus)	1000 : 1321.
Pure " (Rosa)	Violet (Viola tricolor)	1000 : 1462.
Impure dark purple (Symphytum officinale)	Violet-blue (Geranium pratense)	1000 : 1848.

W. TRELEASE.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

United States geologists, sandstones, and the Keweenawan series.

HAVING objected to certain current views in geology and lithology, especially those of one of the preceeding U. S. geological surveys, it is with great pleasure I observe that some of the officers of the present U. S. geological survey, in recent publications, take concordant grounds, in several points, with those published by myself between 1877 and the summer of 1880. These are: 1°. The necessity for the essential union of field and microscopic work, the former to dominate in points relating to the origin of rocks, from the inability of the latter to do what it was claimed it could; and as a reaction against the present too exclusive sedimentary theories; 2°. That propylite has no existence as a rock species, but is an altered state of other rocks (principally andesite), its erection into a distinct species being due to erroneous microscopic and other observations; 3°. That the conglomerate beds of Keweenaw Point are formed in the main from the *débris* of granitic and old rhyolitic and trachytic rocks (the basaltic *débris* is subordinate).

Apropos of Mr. G. P. Merrill's letter in SCIENCE, No. 8, it is proper to state, that, since sandstones are detrital rocks, the minerals contained in them would of necessity have the same inclusions as they had in the rocks from whose detritus the sandstones are formed; and that it has long been known to lithologists, and fully published in the past, that the quartz of sandstones contains fluid inclusions (both with and without moving bubbles), glass inclusions, trichites, etc.

Owing to some remarks in the same number, it is necessary to add somewhat to my previous letter upon Keweenaw Point geology. The evidence advanced by Logan, which Dr. Hunt finds so convincing, was mainly a difference in dip between the traps and sandstones when several miles apart; and all the evidences, as Logan says, only "seem to support the suspicion that the sandstones may overlie unconformably those rocks, which, associated with the trap, constituted the copper-bearing series." The 'Keweenawan series' was first founded on observations on Keweenaw Point; and it, of course, is to live or die there. The observations mentioned in my previous letter are clear, definite, and positive, and substantiate the views of Whitney, Selwyn, and Winchell. They include and explain those of the Michigan and Wisconsin geologists on which the series was based; and, until they are disproved, they definitely show that the Keweenawan series has no separate existence, but overlies, and is continuous with, the eastern sandstone. Dr. Hunt's argument is based on the dictum that the traps underlie the eastern sandstone; and hence his argument is void. Over two years ago the attention of Messrs. Selwyn, Hunt, Irving, and Winchell was called to my observations; and, until they disprove them, it is difficult to see why they should ignore them, and enter upon an interminable theoretical discussion regarding a series which those observations showed did not exist.

Cambridge, Mass., April 3, 1883. M. E. WADSWORTH.

The Ainos of Japan.

A note in SCIENCE of March 30, on the Ainos of Japan, seems to call for a word of comment. A residence of four years in the Island of Yesso, in the capacity of a government official, threw me in almost daily contact with the Ainos, and presented opportunities for studying this most interesting people, which enable me to speak with some degree of assurance concerning them.

That the Ainos of Japan have no race affinities with the Japanese is not to be denied: in fact, all authorities upon the subject, especially those who have studied the people in their own home, are unanimous upon this point. It would seem, however, that, with regard to the Aino population, there is a diversity of opinion, which makes glaring discrepancies in the records given. Having personal acquaintance with some of the authorities which Dr. Brauns cites, — i.e., the missionaries of Hakodate, — and having had abundant opportunity to verify the government statistics by inspection of Aino settlements in various parts of the island, I cannot but feel justified in the statement that the figures given by Dr. Brauns, and so often stated at random by others, are far too large. Statistics compiled for me from the government records show the following population, by provinces: —

PROVINCE.	Male.	Female.
Chisuma	237	223
Hitaka	2,561	2,709
Iburi	1,889	1,837
Ishicari	532	526
Kitami	635	614
Kushiro	732	717
Nemuro	229	244
Oshima	125	120
Shiribeshi	450	407
Teshiwo	186	166
Tokachi	740	758
Totals	8,316	8,321
Grand Total	-	16,637

The province of Chisuma includes all of the Kurile Islands, while the other provinces are embraced in the Island of Yesso. Of the 1,058 Ainos in the province of Ishicari, 750 were brought from Saghalien when that island was ceded to Russia in exchange for the Kuriles, about the year 1876, and are those spoken of by Mr. Brauns as found near Sapporo. With regard to the number of Ainos found on the Asiatic continent, no reliable statistics are to be found; but it is probably large.

The tribute which Mr. Brauns pays to the Aino character is certainly worthy of indorsement; and it would be a pleasure to add to what he says, were it not that want of space forbids, and that these facts will shortly appear in a more permanent form, as they are embodied in a book now nearly ready for the publisher. It only remains to add, that, while the figures given are undoubtedly very near the true population of the various Aino settlements, they cannot be taken as more than closely approximate.

D. P. PENHALLOW.

Houghton Farm, Mountainville, N.Y., April 2, 1883.

PREHISTORIC TREPHINING.

On prehistoric trephining and cranial amulets. By ROBERT FLETCHER, M.R.C.S. Eng., Act. asst. surg. U. S. army. Washington, *Government printing-office*, 1882. 32 p., 9 pl., cuts. 4°.

THIS brochure, which is a part of vol. v. of the Contributions to North-American ethnol-

ogy, gives in a very compact form the facts obtained in regard to the practice of trephining among prehistoric races.

The first communication on the subject was made by Broca in 1877. His attention was directed to certain crania, belonging to the age of polished stone, presenting curious losses of substance not to be explained by the action of weathering. What, then, was the cause of this, and what its object? Pathological anatomy and experiment might answer the first of these questions quite conclusively, while the second lies within the realm of speculation only.

The skulls in question usually had holes in them, the edges of which were partly sharp, rough, and irregular, and partly smooth, eburnated, and slightly bevelled. In a few the latter condition alone was present. The smoothed edges were evidently the result of cicatrization, the diploetic portion having been replaced by a compact, bony structure, thus giving the ivory-like character. Such a process could only have taken place during the life of the individual. Congenital deformity, disease, or injury were the causes which could have given rise to a loss of substance of this sort. The first two are easily excluded for reasons which would at once be accepted as valid by those who have studied the changes produced in bones under such circumstances. An injury, then, remains to account for this; and such can be accidental or intentional. Of the former sort those received in battle are the most common; and had the people of the neolithic time been armed with sharp, cutting weapons, the occurrence of these wounds might have been referable to them. A calvaria in the Musée Broca exhibits a somewhat similar condition, a slice having been removed by the blow of a Tartar sabre. But the weapons of this people were chiefly axes or hammers, which would produce depressed fractures, usually accompanied by a greater destruction of the inner than the outer table of the skull, — the opposite of what had taken place here, as shown by the bevelling.

The theory which explains the condition best is, that a portion of the skull had been removed by scraping or drilling through it. This would naturally give an oblong hole with a bevelled margin. The bone in the immediate neighborhood being healthy, and all signs of re-active inflammation having passed away, it is probable that the operation must have been done long before the death of the individual, and presumably in childhood. Broca demonstrated that a child's skull could be easily scraped through in a few minutes, with the aid of a piece of flint, and that an adult's could be perforated in an hour. A puppy was also experimented upon in the same way by him; and it was found that the operation was well borne, and the animal made a good recovery. In man this rude method of trephining is not necessarily fatal, as there are savage tribes in the South Seas and in Algeria which practise the operation in precisely the same way, with a good percentage of recovery.

This being accepted as the cause, what can have been the object of the operation? Among civilized people the operation is performed to remove diseased or depressed pieces of bone giving rise to symptoms of compression. M. Parrot has exhibited one skull which he thinks shows such was the case. There is no doubt of the evidence of disease; but it does not seem to be clearly shown that this may not have arisen subsequently to the trephining, and entirely independent of it. Among the savage tribes already referred to, the relief of epilepsy is assigned as the reason for the operation; and this is a plausible explanation of its use among prehistoric races.

It will be remembered, that, in the greater number of trephined skulls, the edges of the opening were partly rough and jagged. Such were evidently made after death, as there is no evidence of any attempt at repair; and it is conjectured that pieces of bone were then broken away so as to include a portion of the original cicatrized margin, and that these were subsequently worn as 'amulets.' This is called post-mortem trephining.

The western hemisphere has thus far furnished but one case of trephining among prehistoric people. It was discovered by Squier in an ancient Peruvian. A square piece of bone had been removed, apparently by cutting, and the patient, an adult, had survived but a short time, — fifteen days, according to Nelaton.

The thanks of American investigators are due to Dr. Fletcher for placing within their reach such a well-illustrated *résumé;* and its careful perusal will certainly repay those interested in the subject.

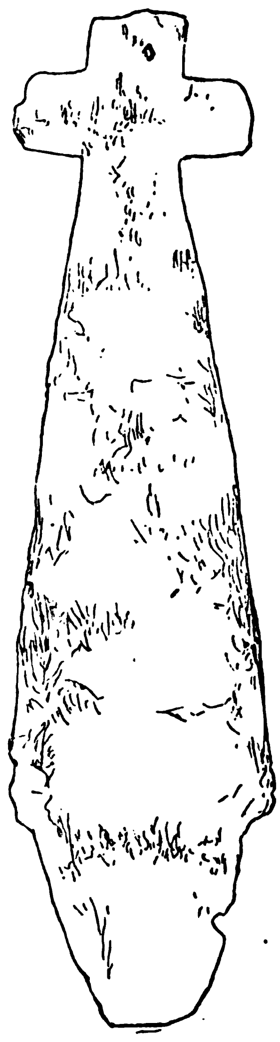
REPORT OF THE PEABODY MUSEUM.

Fifteenth annual report of the trustees of the Peabody museum of American archaeology and ethnology. Vol. iii, no. 2. Cambridge, 1882. [106] p. 44 fig. 8°.

THIS report is chiefly devoted to notes by the curator upon the copper objects from North

and South America contained in the collections of the museum.

The extent to which copper implements were disseminated among the aboriginal tribes of America will be surprising to many. The ornaments and implements lucidly described by Mr. Putnam are from places as widely separated as the burial-fields of Maine, Vermont, Massachusetts, and the mounds of the central and south-western states; besides a fair representation from Mexico, Central America, and Peru. In fact, objects made of copper are as widely distributed in America as are the stone implements of neolithic forms. This, however, does not imply that the same stage of advancement had been reached by copper-using tribes all over this territory. In Mexico, Central America, Peru, and Chili, copper ornaments and implements were cast, and then finished by hammering. Mr. Squier reports remains of furnaces in the ruins of Chimu, where, in early times, copper ores were smelted. In Mr. Putnam's opinion, there is no evidence that copper was ever cast in moulds by the aboriginal tribes of the United States; but native copper was hammered by them, as these cuts show, into innumerable shapes. Figs. 3 (here reproduced), 10, and 11 represent cruciform copper ornaments; but this seems to be a design of natural conception, rather than a symbol of Christianity, as some have supposed. The Sioux draw a figure of the cross to signify the four winds.



CRUCIFORM PENDANT FROM A STONE GRAVE IN TENNESSEE.

Besides the above notes, the report contains, among other things, a brief account of the important exploration now in progress under the auspices of the museum, of an extensive ancient cemetery at Madisonville, near Cincinnati.

The institution needs a great increase of its funds to equip it for its pressing work. Civilization is fast destroying all vestiges of prehistoric races. The science of the whole world and of all time will be enriched by any enlargement of the Peabody museum.

THE PANTHER CREEK COAL-BASIN.

Second geological survey of Pennsylvania. J. P. LESLEY, state geologist. *Anthracite district*, CHARLES A. ASHBURNER, geologist in charge. *Panther Creek basin*, [*in*] *Carbon and Schuylkill Counties*, 10 sheets [vertical sections, 3 sheets; horizontal sections, 3 sheets; map of the mines, 3 sheets; diagram of surface-area, 1 sheet]. — *Topographical map of the Panther Creek coal-basin*, 1 sheet. — *Preliminary map anthracite coal-fields*, 1 sheet. — *Production anthracite coal-fields*, 1 sheet. In all, 13 sheets, 605×725 mm. 1882.

THE constantly increasing use of cartographic and diagrammatic methods in illustration is an evidence of a most healthy advance in thoroughness and accuracy in geological work in this country. It is only within a comparatively few years that any trustworthy topographical maps at all have been available for our geological workers; and even now, outside of those made by government surveys in the west, they cover but a very small proportion of the area of the United States.

The theoretical as well as practical value of a geological map is directly dependent upon the accuracy and detail of its topographical basis; and, no doubt, many bitterly disputed questions which came up in earlier geological work in this country, some of which are still unsettled, would not have arisen, had it been possible to carry on the work originally on a systematic basis, instead of by individual observers who had not the advantage of comparing notes in the field, and who had either no map at all, or such as, from want of accuracy and detail, would be comparatively worthless. For practical purposes, such as the development of mineral deposits, the theoretically perfect map should contain in itself all the necessary data; so that no text would be required as an aid to its use in exploration, this being employed simply for explanation of methods of work and for theoretical deductions.

The thirteen charts now before us, recently prepared by Mr. Charles A. Ashburner, geolo-

gist in charge of the anthracite division of the Second geological survey of Pennsylvania, are a very close approach to this theoretical perfection. They are devoted to the illustration of the Panther Creek coal-basin, the north-eastern portion of the southern anthracite field, included between the Little Schuylkill River on the west, and Mauch Chunk on the east. Of these charts, one sheet gives the reproduction of a topographical map of the basin, made by Mr. R. P. Rothwell in 1869, on a scale of 1,600 feet to the inch, with contour-lines at vertical intervals of 10 feet. Three sheets, forming but one map, show the shape of the floor of the mammoth coal-bed, on a scale of 800 feet to the inch. This is practically an underground map; and in it Mr. Ashburner has introduced the somewhat novel system of representing the shape of a certain bed in the basin by contours, in the same manner as the surface of the ground is represented in our grade-curve maps. These underground curves are printed in red, and are drawn at 50-feet vertical intervals; some of the prominent surface features, such as railroads and important buildings, being printed over them in black.

It seems a pity that Mr. Rothwell's map should not have been published on the same scale, so that it might be superposed upon the underground map; thus showing, at a glance, the difference between surface and underground topography. Such a map shows at once the shape of the basin, and, by the relative closeness of contour-lines, the angle of dip at any point; and from it may be constructed an actual section of the coal-basin on any given line. Twelve of such sections are actually constructed at favorable points, and represented on three other charts on a scale of 400 feet to the inch. They are also given on the same charts on a scale of 1,500 feet to the inch, drawn one under the other, so as to represent more graphically the general shape of the various folds, and the position of the underlying rocks. They are accompanied by a sketch-map of the whole basin on a scale of 2,300 feet to the inch.

On still three other sheets are given columnar sections, representing the thickness of the coal and intervening beds at a number of different points where they have been determined, constructed on various scales, from 10 feet to 300 feet to the inch. One of these sheets also contains a skeleton map of the basin, showing the locality of these sections as well as of the cross-sections.

Furnished with these maps, the mine-owner can tell at what distance a shaft or tunnel may reach the coal-bed from any given point, and the inclination of such bed when reached. He can determine the proximate line of the bottom of the various synclinal basins along which he wishes to run his galleries, and which coal from the various breasts may reach by gravity.

Of the three remaining sheets of the series, one gives a diagram showing, in different shades of color, the area of the respective coal-beds, developed on a horizontal plane; the second, a skeleton map of the entire anthracite region on a scale of $\frac{1}{300000}$, with columnar sections showing the local names of the various coal-beds in different parts of the region, and the names of all the collieries. The third sheet shows the production of anthracite coal, from its earliest development to the present day, both in columns of figures from different districts, and in curves forming a pyramidal diagram for the total product; also some brief historical notes.

The sheets are 26 by 32 inches in size, and are engraved by the reliable firm of Julius Bien & Co. They bear evidence of an immense amount of accurate detail-work; and the only serious criticism we have to make, is the use, by Mr. Ashburner, of the magnetic instead of the true meridian.

The practical value of such maps as these, where underground developments have been carried on to a sufficient extent to furnish data which will make their deductions trustworthy, must be evident to the most untechnical; and that it has been appreciated by the mine-owners of the anthracite region is proved, not only by the practical aid they lent to the work by furnishing all their surveys and measurements, but also by their contributions of money to help defray its expenses. They form a highly instructive lesson of the practical value of a properly conducted geological survey, and one to which the legislators of Massachusetts and Rhode Island would do well to turn a listening ear; for it is certainly a disgrace, in these enlightened times, that they have within the borders of their states a coal-basin of which less is known than of those of the wild, almost uninhabited, regions of the Rocky Mountains.

THE SMITHSONIAN PUBLICATIONS.

Catalogue of publications of the Smithsonian institution, 1846–82, with an alphabetical index of articles. By W. J. RHEES. Washington, *Smithsonian institution*, 1882. 14+328 p. 8°.

A PREFACE states in a general way what the institution has published, the rules for distribu-

tion, and the prices of those numbers which are sold. A detailed chronological list of the 496 issues is then given, followed by a classified list under 29 heads, with some subdivisions, and, finally, by an alphabetical index to the Contributions, Miscellaneous collections and Reports of the Smithsonian, the Bulletins and Proceedings of the National museum, and the First annual report of the Bureau of ethnology. Thus every inquiry that will probably be made is answered beforehand. Is my set complete? Is this volume perfect? What articles are there in this department of science? In what volume or volumes has this man written? In what is this subject treated? How can I get them? How can I procure a set, or get the volumes as they are issued? Indeed, if one must be critical, we should say that answers are provided for some questions which only an idiot could be expected to ask. In the index, not only are references made from the names of the authors, and from the subjects of articles, but from the first words of their titles, however insignificant they may be. Thus we have such entries as *Contributions* to history of fresh-water algae, *Criticisms* of Dr. J. Hahn, *Hints* on public architecture, *Knowledge* of cryptogamous plants, *Means* of destroying the grasshopper, *Method* of preserving lepidoptera, *Narrative* of the Hassler expedition, and scores of others just as unworkmanlike as these, — entries that would make the Index society stare and gasp. In an ordinary book this might be overlooked; but it is unworthy of one which is intended to be one of the monuments of the scientific achievements of our country. It is true, these articles are all indexed in their proper places also; so that the fault is, at worst, one of surplusage. We have seen indexes in which entries were made under *A* and *The*, and there only. Mr. Rhees has not reached this length of absurdity. He may urge that there are people who will look for the articles under the words to which we have objected. It is difficult to over-estimate the mental left-handedness of mankind, but Mr. Rhees is addressing a scientific public. We should be sorry to believe that their training had produced no better habits of thought than he seems to anticipate.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Spectroscopic observations of the transit of Venus. — Tacchini at Rome observed the first and second contacts by means of the spectroscope, in the manner first proposed by Young in 1869. He saw the external contact 54 seconds earlier than his colleague Millosevich, who observed with a telescope in the ordinary way: the second contact (internal) he observed 36 seconds earlier. A discussion shows that the spectroscopic observations are superior in accuracy to the telescopic. An attempt was made to observe the contacts at Palermo in the same way by Riccó, but it failed. At the moment when the planet left the chromosphere, and its atmosphere was on the slit of the spectroscope, both Tacchini and Riccó saw, for a fraction of a second, one or two bands between B and C, which could only have been caused by the planet's atmosphere. — (*Mem. spettr. Ital.*, Dec., 1882.) C. A. Y. [636

Observations of the lunar crater Plato. — A comparison by A. Stanley Williams of a large number of observations taken by himself and others in 1879–82 with a similar series taken in 1869–71 seems to give evidence of change in this crater. Of thirty-seven spots seen in the crater in 1869–71, six were not seen in 1879–82; while seven, not seen during the first period, were seen in the second. The mean visibilities of most of the spots observed in both series agree very closely, but eight show a decided variation in brilliancy. Among the light streaks in the crater, some change was noted, particularly in one which was not seen at all during the first twelve months of the first period, and is now larger and brighter than others previously seen. [This paper is to be continued.] — (*Observ.*, March 1.) M. MCN. [637

MATHEMATICS.

Transformation of surfaces. — Professor Enneper, in this article, has reproduced the substance of two previous articles which he has written upon the same subject, with a number of additions. The particular transformations treated of are defined as follows: the corresponding points P and P_1 of two surfaces S and S_1 are so related to a fixed point O, that the plane through the points O, P, and P_1 contains the normals to the surfaces S and S_1 in the points P and P_1. Among other derived surfaces coming under this head are the pedal and negative-pedal surfaces, inverse surfaces, etc. A generalization of Malus' theorem is given; viz., the surface separating two homogeneous media is regarded from a given point O; at a point P of the surface, the ratio of the sines of the incident and reflected rays is a function of the distance O P: the reflected rays are then the normals to a certain surface and its parallel. The author discusses the problem of finding when lines of curvature upon the given surface S correspond to lines of the same kind upon the derived surface S_1. The results in this case are tolerably well known. — (*Math. ann.*, xxi. 1883.) T. C. [638

Geodesic polygons. — The results obtained by the author, Otto Staude, in this paper, are for the most part known; but his method seems to be entirely new. M. Staude attempts, in a measure, to do for quadric surfaces, by aid of hyperelliptic functions, what has already been done for conics by the aid of elliptic

functions. He limits himself to the examination of geodesic polygons traced upon central surfaces of the second degree. Section 3 of the paper is an excursus upon the thread construction (*fadenconstruction*) of the lines of curvature on quadrics. For an intelligible reading of the paper, a previous paper of the author's, 'Ueber fadenstructionen des ellipsoides,' must be referred to. — (*Math. ann.*, xxi. 1883.) T. C. [639

Complexes of the second order. — M. Genty discusses Kummer's sixteen-nodal quartic by the methods of vector analysis. No new results or properties of this surface are given; but the paper is interesting as an application of this particular method. — (*Journ. de math.*, 1882.) T. C. [640

Hypergeometric series. — M. Mathieu studies the differential equation of the second order, satisfied by Gauss's function F (a, β, γ, χ), and examines briefly the cases when the general solution of this equation can be expressed in a finite form, and obtains, in consequence, the cases when the function F (a, β, γ, χ) can be expressed in finite form. He determines also the cases when the function F $(a, \beta, \gamma, \sin^2 \phi)$ is periodic with respect to ϕ, and has 2π for its period. — (*Journ. de math.*, 1882.) T. C. [641

Parallel surface to the ellipsoid. — Dr. Craig discusses the general equation of this surface, and its principal sections. Certain of its singularities are enumerated, and formulae are given for the ratios of corresponding elements of area and length upon the parallel and primitive ellipsoid. A number of formulae are given, referring to the curvature of the surface. Elliptic co-ordinates are employed throughout the greater part of the paper. — (*Journ. für math.*, xciii.) T. C. [642

PHYSICS.

Heat.

Specific heat of water. — The results of experiments on the specific heat of water at different temperatures differ, not only quantitatively, but qualitatively. Rowland and Münchhausen, whose experiments are the most reliable on this subject, have shown that the specific heat of water decreases to about 30°, and thence increases. In order to test these results, Hr. F. Neesen has made some experiments upon this subject with Bunsen's ice-calorimeter. The calorimeter was constructed according to the plan of Schuller and Wartha, in order to avoid the errors caused by the impurities of the snow. Hr. Neesen points out that it is of importance not to begin the experiment until some indications of melting appear in the ice of the calorimeter. If this point is not observed, the change of volume will be too small. The thermometers used were two mercury thermometers, graduated respectively to 0.2° and 0.1°. The results obtained by Neesen are to be considered merely approximate, as sufficient determinations of the specific heat at each temperature were not made. The results, however, agree qualitatively, though not quantitatively, with those of Rowland. — (*Ann. phys. chem.*, xviii. 3.) C. B. P. [643

Electricity.

High-pressure electric accumulator. — Mr. Frederick J. Smith describes an arrangement for prolonging the life of a gas-battery. The tubes containing the electrode are inverted in a tank nearly filled with dilute sulphuric acid. The tank is closed airtight, and the gases, as they are evolved, generate a pressure, which, as shown by a manometer, amounts to several atmospheres by the time the tubes are filled. The amount of gas which can be thus collected in the tubes is, of course, much greater than that collected under ordinary conditions, and the life of the gas-battery correspondingly longer. When a Faure accumulator is treated in the same way, the electromotive force of the polarization is affeced, but to what extent is not yet definitely determined. — (*Phil. mag.*, March.) E. H. H. [644

Bifilar suspension and absolute measurement. — F. Kohlrausch gives a mathematical treatment of the bifilar suspension, obtaining, as the complete expression for the directive force,

$$D = \frac{g}{l}\left[m\frac{e_1 e_2}{4} + \frac{2\pi\rho^4 E}{5}\right],$$

where m is the mass of the suspended body increased by half the mass of the wires; e_1 and e_2, the distance apart of the upper and lower ends respectively; ρ the radius, and E the modulus of elasticity, of the suspending wires; g, the acceleration of gravity; and l, half the mean length of the wires, diminished by $\rho^2\sqrt{\frac{2\pi}{m}E}$. Hence he deduces two methods of measuring the horizontal intensity of terrestrial magnetism, which he calls the bifilar-galvanic and bifilar-magnetic respectively. The first method consists in observing the deflections a of a magnet, and ϕ of a circular coil suspended at a distance a from the magnet, when $H^2 = \frac{D \tan a}{a^3 \tan \phi}$, subject to certain corrections. The second method consists in observing the deflections a and ϕ of two magnets, one large in respect to the other, when $H^2 = \frac{D}{a^3(1+T)}\left(1 - \frac{3}{8}\frac{d^2}{a^2} + \frac{\lambda^2}{a^2} - 2\frac{K}{a^3}\right)\frac{\sin a}{\tan \phi}(1 - 2\tan a \tan \phi)$, where d is the distance between the poles of the larger magnet, $K = \frac{M}{H}$ for the smaller magnet, λ its length, and T its torsion-co-efficient. On the 21st of October, 1881, the first method gave .19407, and on the 16th of February, 1882, the second method gave .19389, $cm^{-\frac{1}{2}} g^{\frac{1}{2}} sec^{-1}$, at Würzburg. — (*Ann. phys. chem.*, Dec., 1882.) J. T. [645

ENGINEERING.

Boston water-works. — An elaborate description of the additional supply of water for the city of Boston from Sudbury River, compiled by Mr. A. Fteley, the resident-engineer upon the work during its construction, has just been issued by the city government in a large, finely printed, and copiously illustrated volume. The works for supplying Boston with water from Sudbury River consist of three storage-reservoirs in Framingham, and a conduit from that town to Chestnut-hill reservoir in Brookline. In 1881 Sudbury River furnished to Boston more than twice the quantity of water supplied from Lake Cochituate; and steps have already been taken to increase still further the storage-capacity of the system. The volume begins with a discussion of the sources of supply, the rainfall, and the storage-capacity of the reservoirs. Next follows a general description of the dams and reservoirs, and of the several sections of the work, in all its engineering features. The quality of the water, the gauging of the river, and a discussion of the capacity of the conduit, and the flow of water over weirs, conclude the body of the work. The appendix contains valuable tables on water-supply hydraulics, and a large amount of information for the practising engineer. The work is illustrated with 69 large plates, commencing with a map of the Sudbury River watershed, and giving very fully the construc-

tive details of the dams and conduits. To give the city 40,000,000 gallons of water daily, it is estimated that the storage-reservoirs on Sudbury River should have a capacity of 4,900,000,000 gallons. So far, three reservoirs only have been built; having a capacity, with that of Farm Pond, of 2,000,000,000 gallons, intended to give a supply of 20,000,000 gallons daily to the city. — G. L. V. [646

Anthracite coal-fields of Pennsylvania. — Mr. Charles A. Ashburner read a paper on a new method of estimating the contents of highly-plicated coal-beds, as applied to the anthracite fields of Pennsylvania. The questions of the future production and ultimate exhaustion of these fields are of the greatest importance. In 1860 the population of the United States was 31,443,321, and 8,513,123 tons of coal were produced; i.e., actually shipped to market. In 1870 the population had increased twenty-two per cent (38,558,371), and the production of anthracite was nearly doubled, being 16,182,191 tons. For the year 1880, with a population of over 50,000,000, the product was 23,437,242 + tons. In 1882 the actual production was over 30,000,000 tons. It has been variously estimated that the 470 square miles containing this coal in Pennsylvania will be entirely exhausted in from 140 to 204 years. While Mr. Ashburner does not estimate the ultimate exhaustion, he has devised a method for estimating the contents of these fields from data now being obtained by the careful and practical geological and mining examinations of the state survey. The exact position and detailed structural shape of the coal-beds are first mapped by fifty-feet contour-lines along the floor of the beds, giving, completely and satisfactorily, their geometrical construction and shape. These surfaces are then developed into planes by the development into straight lines of the line of the bed, as cut by paralleled section-planes 1,600 feet apart. This graphical method is attended with errors which are mathematically discussed, and which have been formulated by Mr. Arthur Winslow. This method does not give the true area of the surface of a sphere, cone, or triangular trough. In the case of a sphere, it gives $\frac{\pi}{4}$ of the true area; in a cone, the error increases directly as the secant of the angle which the pitch of the cone makes with its axis; and in a triangular trough, which more nearly represents the shape of the anthracite basins, the error is very much less. A practical test has been made of this method in the Panther Creek basin, between Mauch Chunk and Tamaqua; and the maximum possible error in estimating the surface-area of the coal-beds was found to be .905 of 1 per cent. After the areas are thus found, the contents are obtained by careful measurements made in the mines to ascertain the actual number of tons of coal which are contained in a unit (one acre) of bed-area. In this way it has been estimated that the above basin originally contained 1,032,000,000 ± tons; that the area under development originally contained 92,000,000 ± tons, out of which latter area 54,000,000 ± tons have been taken. — (*Eng. club Philad.; meeting* March 17.) [647

CHEMISTRY.

(*Analytical.*)

Determination of organic matter in potable water. — In an extended examination of the various methods in use for determining the purity of potable water, undertaken by Prof. J. W. Mallet for the National board of health, special attention was given to the 'combustion process' of Frankland and Armstrong, the 'albuminoid-ammonia' process of Wanklyn, Chapman, and Smith, and the 'permanganate' process suggested by Forchhammer. Prof. Mallet finds that it is unsafe to base conclusions on a single determination by the combustion process; and the evaporation should be conducted by means of steam, in such a manner as to preclude the possibility of absorption of ammonia from the atmosphere. It was also found advantageous to conduct the evaporation under diminished pressure at quite low temperatures. In the albuminoid-ammonia and permanganate processes the most desirable results were obtained by keeping the volume of liquid in the retort constant and the permanganate in excess. Prof. Mallet thinks that more importance should be attached to the quantity of nitrites and nitrates than is usually assigned to them; and he finds that they may readily be reduced by phosphorous or hypophosphorous acid. These methods are regarded by him as an insufficient basis on which to reach a decision as to the condition of a water; and they should be made of secondary importance to evidence of a general nature, such as the source and history of the water examined. A thorough biological examination of water polluted in various ways is recommended. — (*Amer. chem. journ.*, iv. 241, 334, 426.) C. F. M. [648

Composition of a spring-water from Salzbrunn. — In an analysis of a spring-water from Salzbrunn, in Silesia, T. Poleck obtained the subjoined results in 1,000 grms.

Sodium chloride	0.05899 grm.
" sulphate	0.18010 "
Potassium sulphate	0.04085 "
Sodium bicarbonate	0.87264 "
Lithium "	0.01140 "
Calcium "	0.71264 "
Magnesium "	0.40477 "
Strontium "	0.00280 "
Manganese "	0.00181 "
Aluminum phosphate	0.00036 "
Alumina	0.00047 "
Silicic acid	0.03460 "
Total	2.23057 grms.

Bromine, boracic acid, barium, and nickel were present in quantities too small to be determined quantitatively. The free carbonic acid in 1,000 grms. amounted to 849.4 cc., at 10.5°, and 740 mm. pressure. This water would be classified as *alkaline-saline*, and also as strong *sodium-lithium.* It contains only minute traces of organic matter. — (*Journ. prakt. chem.*, xxvii. 45.) C. F. M. [649

Origin of arsenic and of lithium in waters containing calcium sulphate. — In examining different natural waters for arsenic, from Martigny, Bachu, and other localities, M. Schlagdenhauffen finds it in quantities varying between 0.0050 grm. and 0.0500 grm. per litre. Since arsenic is found in different varieties of gypsum, the author concludes that it is in the form of calcium arseniate. Its origin may be traced to the marls, where it existed as sulphide. By the action of acid calcium carbonate, it was probably converted into the sulpho-arseniate, and finally into the arseniate. When certain marls are submitted to the action of hydrochloric acid, the solution evaporated, and the residue extracted with a mixture of alcohol and ether, lithium may readily be detected by the spectroscope. Five grms. of the earth contain sufficient lithium to give a distinct red band. — (*Journ. pharm. chim.*, l. 464.) C. F. M. [650

AGRICULTURE.

Symphytum asperrimum as fodder. — This plant is reported to yield a large quantity of palatable and nutritious green fodder, even on poor soil,

and, under very favorable circumstances, to give as many as six crops per year. Experiments by Weiske confirm the fact of a large yield, and show that it is also fully as digestible as good hay, and contains a large proportion of nitrogenous nutrients. It is not always eaten freely, especially in the form of hay, and appears to be best adapted for soiling, or for the preparation of ensilage. — (*Journ. landw.*, xxx. 381.) H. P. A. [651

Fattening different breeds of sheep. — It is a well-known fact, that, in different breeds of the same species, the same fodder may produce very different effects. All experiments hitherto, however, have failed to show any notable differences of digestive power in such cases; and it would thus appear that the observed differences are due to the varying energy with which the constituents of the body are oxidized. In an experiment with two mature sheep, a southdown and a merino, on identical rations, from which identical amounts of the several nutrients were digested, Weiske found that the apparent gain of 'flesh' (nitrogenous matters) was greatest in the merino sheep; but this difference was somewhat more than covered by the greater growth of wool. So far as this single experiment proves any thing, it shows that not only the digestive powers, but also the proteid metabolism, of different breeds of sheep, are essentially the same, and indicates that the differences in the ease of fattening are due to differences in the rapidity with which non-nitrogenous substances are oxidized in the body. — (*Journ. landw.*, xxx. 385.) H. P. A. [652

Valuation of fodders. — The commission appointed in Germany in 1878, to devise a uniform method for calculating the money-value of fodders from their chemical composition, held its fourth meeting at Eisenach, Sept. 17, 1882, a report of which is presented by Prof. J. König. An abstract was presented of papers published on the subject since the last meeting of the commission; and this was followed by a discussion of the results thus far attained. No final conclusions were arrived at; but it was recommended, that, in such computations, the same price be assumed for crude proteine and crude fat, and that the carbhydrates be estimated at one-fifth the price of proteine. It is expressly set forth that this is only a provisional decision, and further investigations and computations are called for. — (*Landw. jahrb.*, xi. 849.) H. P. A. [653

Testing milk. — Jörgensen proposes to use the index of refraction of milk, or of whey prepared from the milk, as a test of purity, and asserts that it shows comparatively small variations, while even a small addition of water is plainly indicated. Chludsinski considers it necessary to determine the specific gravity of the whole milk and of the skim-milk, and the percentage of cream, in order to judge of the purity of a sample, and describes an instrument for this purpose, the specific gravity being determined by weighing a measured quantity of the fluid. — (*Landw. jahrb.*, xi. 701, 835.) H. P. A. [654

GEOLOGY.

Meteorites.

The Bishopville meteorite. — Dr. M. E. Wadsworth stated that a microscopic examination showed that the Bishopville meteorite, which fell in March, 1843, was composed of enstatite, felspar, augite, olivine, pyrrhotite, and nickeliferous iron. The enstatite contained many glass inclusions of similar form to the enclosing mineral. Numerous glass inclusions were also seen in the felspar, and many in both minerals were bubble-bearing. Most of the felspar showed the twinning of plagioclase. Glass inclusions have always been regarded, when found in terrestrial rocks, as indicating igneous origin. The composition and structure of this crystalline stone is like that of the gabbro (norite) variety of basalt. While, according to common custom, the speaker might have proposed a new name for this, he preferred to call it a gabbro or basalt, in accordance with the principles announced in SCIENCE of March 9. Chladnite, he said, was not a pure enstatite, but a crystalline aggregate of enstatite, felspar, augite, and olivine. The well-marked glass inclusions and the structure of this stone had, according to the speaker, an important bearing upon the question of the origin of meteorites, and were in accord with his previously published views. — (*Bost. soc. nat. hist.; meeting* April 4.) [655

METEOROLOGY.

Aurora borealis. — Herr H. Hansen's observations of the November (1882) auroral displays in Trondhjem, Norway, show that each continued an extraordinary length of time, especially during the week Nov. 12-18. Every night of this week the heavens were illuminated with the auroral light, while it was seen from 8 P.M. on the 17th till 6 A.M. of 18th. The most striking display occurred on the 18th, at 4.30 A.M., when a brilliant corona appeared in the zenith, from which vivid streams of light stretched to the horizon; while luminous waves flowed uninterruptedly from the latter towards the corona, diffusing so strong a light as to enable one with ease to read moderately clear print. — (*Nature*, Feb. 8.) H. A. H. [656

Polar research. — The French magnetic and meteorologic expedition to Cape Horn has taken up quarters at Orange Bay, Terra del Fuego, east side, lat. 55° 31′ S. Observations began Sept. 26, 1882. The party found the climate mild, the temperature, up to the time of the report, ranging from freezing to 61°. — (*Nature*, Feb. 8.) H. A. H. [657

PHYSICAL GEOGRAPHY.

Granular structure of glaciers. — E. Hagenbach-Bischoff reviews the previous study of this question from Hugi to Klocke (*Neues jahrb. miner.*, 1881, i. 23) and Forel (*Arch. sc. phys. nat.*, 1882, vii. 329), and shows by optical and physical characters that each grain of a glacier is a single crystal of ice. The crystals stand with their axes in all positions, so that their contact surfaces form a very irregular network of polygonal planes. When the ice is broken at a temperature below its freezing-point, the subconchoidal fracture is independent of the crystals; but on melting, the crystals separate along their contact surfaces, as is shown by the planes of penetration of a colored liquid (soluble aniline blue is best). As has long been known, the grains are smallest in the *névé*, and largest at the end and bottom of the glacier, where one was found measuring 14, 12, and 9 cm. Forel has thought that this growth comes by the addition of infiltrating water, and that the motion of the glacier is thus aided; but this supposes that the ice is porous enough to allow water to enter, and requires a low internal temperature (for an annual increase of 0.043 cubic or 0.014 linear measure, the ice must average −7° C.). Hagenbach-Bischoff contends that certain crystals grow at the expense of their neighbors: as the expansion of a freezing ice-crystal is greater along one axis than another, it follows that pressure will lower the melting-point by the greatest amount when directed along the axis of greatest expansion; consequently those crystals whose

axes of least expansion are parallel to the direction of pressure will grow at the expense of the neighboring crystals, whose axes of greatest expansion are most nearly parallel to the pressure. Hence only certain crystals grow; the others decrease and disappear: as a result, all the former should have their axes parallel to one another, and to the average greatest pressure when they arrive at the lower end of the glacier. The author found thirteen out of fourteen samples taken from the grotto at the foot of the Rhone glacier to have their axes vertical; others have noticed the same predominance of vertical crystals at the lower end of the Grindelwald and the Aletsch glaciers. It is possible that both these modes of growth occur together. To determine this and other long-lasting mysteries of glacial phenomena, many more observations are needed on the internal temperature and constitution of glacial ice. — (*Verh. naturf. gesellsch. Basel*, 1882, vii. 192; *Arch. sc. phys. nat.*, 1882, viii. 343.) W. M. D. [658

GEOGRAPHY.

(*South America.*)

Eastern Patagonia. — The records have lately been found of an expedition into eastern Patagonia, between lats. 43° and 47°, made in 1877 by the late H. Durnford, an English ornithologist, who died in South America in 1878. Durnford was accompanied by Messrs. Griffiths and Jones from the Welsh colony near the mouth of the river Chupat (Chubut of Moreno), and made a distance of about three hundred miles to the south-west before turning back. Important observations were made on the position and size of several rivers — Sengel, Sengellen, and Chupat — and lakes, — Colguape (Coluhuape) and another equally large (later named Lake Musters by Moreno), — besides many smaller salt lagoons, all shallow, and apparently much decreased from their former extent. The country was very monotonous, showing nearly everywhere the same barren sterility, occasionally relieved by a lagoon or gully containing water. Bare hills and slopes of sandy marl, and volcanic rocks of varied shape and color, from pale brick-red to black, formed the general surface. Sometimes the traveller's way led across deposits of soft, yielding dust, and again over hard, unbroken rock. The animal and plant life, wherever found, was stunted and dwarfed. Evidence of former marine submergence was found on the table-land in well-rounded pebbles, gigantic oyster-shells, and numerous fragments of smaller shells. The rivers are now sunk in many places several hundred feet below the plain, and flow between steep banks. Numerous cairns containing Indian skeletons were found on hilltops. They are carefully built of stone, the blocks often being of a considerable size. The route followed by Durnford's party was like that taken by Moyano in 1880. — (*Proc. roy. geogr. soc.*, 1883, 84.) W. M. D. [659

Rio Pilcomayo. — A brief note furnished by Marguin, a member of Fontana's expedition in search of Crevaux, shows the Pilcomayo to be one of those newly established rivers on a very flat surface, with but little descent to its base-level of drainage. The exploration reached lat. 24° 40′ about one hundred miles from Asuncion, on the Paraguay; and, especially in the upper half of this distance, the river meandered very irregularly through a low forest-covered country, often interrupted by lagoons. Its banks were naturally raised about twelve feet by deposits of sand in five-inch strata, separated by thin layers of vegetable origin; and at time of flood the waters were thus divided into three parallel courses. As the water of the main channel subsided, the overflow drained back through breaches in the banks, having temporarily the appearance of affluents. The channel was often interrupted with snags, and bore signs of frequently changing its position to avoid the bars formed about them. The several neighboring streams (Rio del Fuego, Aguaray-Guazu, mboicae, Confuso del Sur), by which part of the Pilcomayo may have once been discharged into the Paraguay, are regarded as its former channels abandoned by these changes. Marguin recalls Padre Patiño, who attempted to ascend the river in 1721, but was forced back by the Indians on approaching lat. 23°; Van Nivel and Acha's attempt from Bolivia in 1844, which failed to pass a great lagoon at some point farther up stream than Patiño's goal; and, finally, Crevaux' party, which more nearly attained success than any of the others. — (*Comptes rendus soc. géogr. Paris*, 1883, 60.) W. M. D. [660

Antioquia. — The narrative of a journey through this north-western province of Colombia, by Fr. v. Schenck, gives an entertaining account of its inhabitants and their condition. On the way inland from the northern seacoast, Schenck found the navigation of the Magdalena a difficult undertaking, from its numerous sandbars, and shifting, entangled channels. Below Magangué its valley is fairly cultivated; but farther up stream the forest wilderness is hardly broken for a long distance, and the towns named on the maps are represented by a few huts occupied by negroes and chinos, who supply the river-steamers with wood. This region is very warm and unhealthy. The ruins of a few chapels remain from the early times of Spanish occupation, but they have been long abandoned by the priests. Farther south, where the river forms the eastern boundary of Antioquia, which Schenck regards as the best province of the country, there is more clearing; the people are industrious, and of a much better morality than those of Spanish descent generally are, so that the traveller calls them Puritans. The road from Naré (about 150 met. elev.), on the Magdalena, westward to Medellin (1,480 met.), crosses two ranges that rise to 2,220 and 2,530 metres. An interesting description is given of Medellin, where the author found a curious mixture of civilized comforts with the makeshifts of an isolated region. An excursion was made northward, over a plateau, to the gold district of Santa Rosa de Oros, and beyond to the falls of the Guadalupe (lat. 6° 46′ N.), — the highest (250 met.) in Colombia, surpassing those of Tequendama (139 met.), near Bogotá, in the surrounding scenery as well as in height. The falls of the Guadalupe have also the advantage of being well seen from a neighboring point of view, where the stream is in sight from its upper placid flow, past the rapids to the cataract, which glides over a sloping, rocky surface to the gorge below. The climate of Antioquia is considered healthy, except in the low, warm valleys. In January and February the air is cool, and the sky clear. There are two rainy seasons, — in the north, from March to June, and from August to November; and in the south, from March to May, and from September to November. The rainfall thus seems to depend on the solar culmination; and the dry season, on the occupation of the country by the trade-winds. — (*Peterm. mitth.*, 1883.) W. M. D. [661

BOTANY.

Cryptogams.

The rot in European grape-vines. — Professor Millardet of Bordeaux, in a paper entitled 'Pourridié et Phylloxera,' explains how the attacks of the well-known Phylloxera destroy the grape-vines in France.

The insect produces larger swellings in the roots, which Millardet calls nodosities, and smaller swellings, which he calls tuberosities. The nodosities appear at any time from April to September, whilst the tuberosities are not found before August. The rotting of the roots is caused by the invasion of a fungus which enters through the cracks in the nodosities and tuberosities. According to Millardet, the fungus is what is known as Rhizomorpha subterranea when it occurs in the ground, and R. subcorticalis when it grows in the roots and stems. Hartig and others consider the fully developed form of the Rhizomorpha to be the toadstool (Agaricus melleus), which is common near Bordeaux, especially on oaks. The mycelium of this fungus makes its way into the soil of the vineyards from neighboring groves, and enters the roots of the vines which have been attacked by the Phylloxera, and produces a white rot, commonly known as pourridié. The writer concludes as follows: "It is beyond doubt, that the disease caused by Phylloxera predisposes to that of the rot. Should one say in these cases that the vine succumbs to the rot and not to the Phylloxera? Evidently not; since, without the Phylloxera, the rot would not have made its appearance." — W. G. F. [662

Two curious fungi of the United States. — The two genera Testicularia and Cycloderma were described by Klotzsch in 1832; but since that date botanists have been unable to recognize the two genera with certainty. Cooke now describes a new Cycloderma Ohiensis, and shows that the Milleria herbatica of Peck is the long-lost Testicularia cyperi of Klotzsch. — (*Grevillea*, March, 1883.) W. G. F. [663

Bangiaceae of Naples. — The eighth monograph of the fauna and flora of the Bay of Naples comprises the Bangiaceae, by Dr. G. Berthold, and is of interest, since he now gives the details of the formation of the spores; these are formed by the action of antherozoids on the cells of the thallus, which can hardly be said to produce trichogynes, as is the case in all other Florideae, to which, however, the Bangiaceae apparently belong. — W. G. F. [664

Bacteria in fishes. — Olivier and Richet have examined 150 fishes of different genera and species, and find, in all cases, that there are microbes in the blood and lymph. They conclude, that, contrary to what is believed to be the case in other vertebrates, microbes occur normally in the fluids of fishes. — (*Comptes rendus*, 1883.) W. G. F. [665

Phenogams.

Functional differentiation in stamens. — Fritz Müller adds Mollia, Sagerstroemia, and Heteranthera to the list of plants having two sets of stamens in each flower, one of which attracts insects, and supplies them with food, while the other serves for pollination by their aid. Experiments show that the crape-myrtle (Sagerstroemia), though self-sterile, is readily fertilized by pollen from either set of stamens of another variety grown in other gardens. The dull color of the longer stamens in the cases mentioned, and of the long stamens in short and mid-styled flowers of the trimorphic Lythrum, is explained as beneficial, as their lack of conspicuousness renders these unprotected stamens less liable to the depredations of pollen-eating insects than would otherwise be the case. As examples of plants whose stamens are differentiated into sets having different forms and offices, but without the color-contrasts found in most instances, a species of Cassia and Solanum rostratum are mentioned. — (*Nature*, Feb. 15.) W. T. [666

Capture of prey in Sarracenia. — In a compilation on pitcher-plants, Mr. James makes the curious suggestion that the insects which are found so abundantly in the pitchers of Sarracenia purpurea are first intoxicated by feeding on the pollen or nectar in its flowers, whence they fall into the leaves. — (*Amer. nat.*, March.) W. T. [667

Bee-flowers. — In his 'signs and seasons,' John Burroughs states that hepaticas are sometimes fragrant, sometimes scentless, the same being true of the arrow-leaved violet. Humblebees perforate flowers of the locust for their nectar, and hive-bees afterward make use of the openings. Rarely the honey-bee works upon the blossoms of trailing arbutus. In midsummer it reaps a harvest from the smooth sumach. It has also been observed on the white oak and skunk cabbage. — (*Century mag.*, March.) W. T. [668

Origin of anemophilous flowers. — Adaptation to fertilization in the wind-swept, treeless areas over which they prevail, is believed by Grant Allen to be the reason for the inconspicuous wind-fertilized flowers of grasses, which are considered degenerate descendants of conspicuous-flowered plants related to the Liliaceae. Passing notice is given to the pollination of rushes, sedges, and related plants. — (*Macmillan's mag.; Pop. sc. monthly*, March.) W. T. [669

New Passifloreae. — The collection of Passifloreae made by M. André in Ecuador and New Granada in 1875 and 1876 has been worked up by Dr. Masters. It comprised nine species of Tacsonia and over thirty of Passiflora, half of which are new. The list is accompanied with numerous critical notes and with revised synonymy, as supplementary to Masters's monograph of the order in the 'Flora Brasiliensis,' and to Triana and Planchon's of the New Granada species, — all the more valuable for the unusual excellence of André's specimens, and his descriptive notes and careful analytical drawings from the living plants. — (*Journ. Linn. soc. Lond.*, Feb., 1883.) S. W. [670

ZOÖLOGY.

Mollusks.

Disease in oysters. — A new disease has recently appeared in the Rappahannock oysters, called, locally, 'the black spot.' A small black spot, imperceptible to a careless observer, appears upon the oyster, and shortly afterward death ensues. All around the spot the meat is good; but this, when bitten into, proves bitter and nauseous. It is considered the most serious of the afflictions to which the mollusk is subject. — (*Hopson's Sea world*, March 15.) W. H. D. [671

Venus mercenaria in Britain. — It appears from a note by Mr. F. P. Marrat, that Venus mercenaria L., our round clam or quahaug, has become naturalized in British waters. In 1869, Capt. I. H. Mortimer introduced this shell-fish into England, where specimens were put into the sea at Southport, at the mouth of the Mersey, and at Crosby, on the Lancashire coast. It is believed that an American, Mr. H. D. Brandeth, doing business at Liverpool, and residing at Hilbre Island, near the mouth of the Dee, deposited both this species and the American oyster in the waters adjacent to the island, four or five years ago. At all events, large numbers of the shells of the Venus have recently been found by collectors, cast up on the shores near Hilbre Island in such a manner as to indicate that this species has become fully acclimatized there. — W. H. D. [672

Insects.

Innervation of the respiratory mechanism in insects. — Dr. O. Langendorff denies Dönhoff's state-

ment that respiratory movements in insects cease after decapitation. Experiments on humble-bees, wasps, cock-chafers, and dragon-flies, show that these movements continue in the abdomen after removal of the head, and even of the thorax. Indeed, in some cases, sections of the abdomen of a dragon-fly, as small as one ring and a half, continued the rhythmical respiration. It is therefore evident that the nerve-centre for respiration is not in the head. A decapitated cock-chafer breathed for an hour. Heat was found to increase the activity of respiration in mutilated, as in healthy individuals. Graphic illustrations are given of normal respiration, and compared with those obtained from decapitated specimens. — (*Archiv anat. phys.*, 1883, 80.) E. B. [673

(*Economic entomology.*)

Food of Carabidae and Coccinellidae. — The view of the habits of the two principal predaceous families of Coleoptera, which is common among entomologists, is largely due to hasty generalization, based upon insufficient data. Observations of the food of these beetles have hitherto been left almost wholly to chance. Two years ago Prof. S. A. Forbes and Mr. F. M. Webster published the results of a series of careful investigations of this subject. This work has been continued by Prof. Forbes, who now gives the result of an examination of the contents of the stomachs of 175 specimens (representing 38 species and 28 genera) of Carabidae, and 38 specimens (7 species and 4 genera) of Coccinellidae. A great diversity of habits of the different genera appears. Thus no trace of vegetable food was found in Calosoma; in Galerita, from 6% to 12% of the food was vegetable; in Pterostichus, 20% to 25%; and in Harpalus, 87%. In the Carabidae as a whole, 57% of the food was vegetable, and 36% insects. In the Coccinellidae, 45% was spores of fungi, 14% pollen of grasses and Compositae, and 35% insects. — (*Bull. Ill. state lab. nat. hist.*, No. 6, Jan., 1883.) J. H. C. [674

Food of Wisconsin birds. — Under the title 'Economic relations of Wisconsin birds,' Prof. F. H. King publishes notes on nearly three hundred species which occur in that state. This work is of especial interest to economic entomologists, as it contains the results of an examination, by a very careful worker, of the contents of the stomachs of over eighteen hundred birds. To the original observations are added notes from the publications of various ornithologists; so that a fairly complete *résumé* of what is known respecting the food of each of the species is given. — (*Wisc. geol. surv.*, i.) J. H. C. [675

VERTEBRATES.

Motor-nerve endings. — W. Kühne has published two articles on this subject, having extended his observations to a considerable number of vertebrates. He gives descriptions of the manifold forms of the terminal ramifications of the axis-cylinder in various species. As the best method of bringing this *axialbaum* into a visible state while preserving its natural form, he recommends giving a minimum dose of curare, and then sending tetanic electric irritation through the nerve. After this treatment, the motor-plates can be seen with surprising ease and distinctness. Particularly important is his new method of isolating the end-plates. Gold preparations are softened in slightly acidified glycerine until the muscular fibres can be pressed apart, which, being done, isolated terminal plates are found, showing the real arborization, which is quite different from the apparent arborization before isolation. The ramifications are composed of the axis-cylinder, and a sheath of substance to which Kühne gives the not very suitable name of stroma, and which separates the axis-cylinder from the fundamental substance of the motor-plate. A fuller notice will be given upon the appearance of the definite memoir, with the promised illustrations. — (*Verh. naturh.-med. ver. Heidelb.*, iii. 97, 212.) C. S. M. [676

Nerve-endings in muscles. — The terminal ramifications in Rana are formed, according to Trinchese, of little disks, placed at more or less regular distances from one another, being separated by a homogeneous intermediate substance. From these (Kühne's) ramifications, on the side towards the muscles, run out numerous very fine filaments. The 'longitudinal striae' (fibrillae?) of the muscle have a similar structure to that of the axis-cylinder, being formed of disks united by clear intermediate substance; and the disks are united by lateral filaments with one another. In the intercostal muscles of the boaconstrictor the motor-plates are often subdivided into five or six parts, lying asunder, though connected by filaments. — (*Att. accad. lincei*, 1882, 83.) C. S. M. [677

Motor-centres in the cerebral cortex. — As an appendix to an article on the irritability of the spinal cord, Schiff enters into a long discussion on the nature of the so-called 'motor centres' in the gray matter of certain convolutions of the cerebral hemispheres. The article is too long and too polemical to be briefly abstracted, but is well worth reading. Schiff points out, that, with the exception of Ferrier, all experimenters (even including Fritsch and Hitzig) have given up the belief that the irritable areas are the motor centres for voluntary movements, and account for the phenomena following stimulation in other ways. Schiff's own belief is, that the so-called motor areas are but reflex centres, in which, during the normal functioning of the body, tactile nervous impulses are reflected to the true and deeper-lying motor centres. — (*Pflüg. archiv*, xxx. 212.) H. N. M. [678

Mammals.

The domestic animals of Camargue. — Col. Basserie gives some interesting facts regarding the domestic animals of this large, low-lying, and marshy island, which is situated at the mouth of the Rhone. The sheep, of the Rambouillet breed, are small and rough, but of peaceful disposition, and very vigorous. They furnish good meat and wool, which has long been esteemed in France for its length and fineness. The cattle are black, small, nervous, and very energetic. They live in the wild state in the great marshes of the island, and are absolutely of no value to the husbandmen; nor do they furnish a means of entertainment, as they did in the days when bull-fights were not prohibited. The horses, which, like the cattle, receive almost no care, and are constrained to feed upon the coarse vegetation of the marshes, and to endure great and sudden changes of temperature and thirst, are small and ill-appearing, having massive jaws, and large and prominent joints and ligaments. They are, nevetherless, hardy, energetic, and subject to few diseases. In color they are light gray. — (*Bull. soc. agric., etc., de la Sarthe*, xxviii. 521.) F. W. T. [679

The nature of elephant's milk. — "According to the *Moniteur scientifique*, the milk of the elephant has a composition very closely allied to that of cow's milk. The globules of butter are large, transparent, and have sharply defined contours. The fatty matter has a clear yellow color. It is liquid at ordinary temperature, and solidifies at 18° C. below zero." — (*Revue scient.*, Jan. 13.) F. W. T. [680

ANTHROPOLOGY.

American archeology in Europe. — Dr. Daniel G. Brinton called the attention of the Numismatic and antiquarian society of Philadelphia, on March 1, to the following facts, with reference to the studies of American prehistoric antiquity. The stone sculptures, first discovered by Dr. Habel and described in the Smithsonian contributions to knowledge, have been removed from Santa Lucia Cozumelhualpa, near Guatemala, to the Royal museum of Berlin. Prof. Adolph Bastian, director of the museum, has published a description of them in a quarto of thirty pages, with three full-page lithographic plates. Within the last year or two, Prof. Leon de Rosny has visited Madrid, Dresden, Basle, and other cities, to study the relics of American civilization. In Madrid he identified the continuation of the 'Manuscript Troano,' which he is now preparing for the press. Count Hyacinthe de Charencey has collected into an octavo volume of a hundred and ninety-five pages his essays on American philology and paleography. Dr. Hamy discusses the cross of Teotihuacau. The Marquis of Nadaillac has brought out a volume on prehistoric America; and Dr. Max Steffen gives us a monograph on the agriculture of the ancient American civilized peoples, — the Aztecs, Mayas, Chibchas, and the Quichuas. The full titles of these works are given in the paper cited. — J. W. P. [681

The Mexican national museum. — It may not be known to all the readers of SCIENCE that the land of the Aztecs is no longer open to the indiscriminate plunder of relic-hunters. There is at the national capital a museum, rich especially in relics of ancient Mexican history. A quarterly report is issued, called *Anales del museo nacional de Mexico*, now in its third year, which is liberally circulated to libraries throughout the United States. Much of the space in this publication is devoted to archeology and decipherment of ancient inscriptions. The principal contributors are J. Sanchez, Gumesindo Mendoza, Orozco y Berra, and Sr. d. Jcazbalceta and Alfredo Chavero. Señor Chavero has for a long time been prosecuting his studies upon the ancient Mexican calendar; and Señor Mendoza has collected a large number of Nahua myths, which he is giving to the world. The anales is printed by Ignacio Escalante, No. 1, Bajos de San Agustin, Mexico. — J. W. P. [682

Anthropology of France. — The study of the natural history of man is very similar to the science of geology. It is possible to select a certain epoch, — say, the glacial, — and trace over all the earth the evidences of its extent. We may seek to comprehend the succession of all the epochs throughout our planet; or, selecting a particular locality, the specialist may study minutely the exact order in which the various strata have manifested themselves there. The anthropologist now traces up the wanderings of the Celtic stock, now seeks to unravel the mystery of races, and finally, circumscribing his search to his own land, inquires how various stocks of men have succeeded one another in its borders. Such a work has M. Gustave Lagneau done for France. Various tentative efforts were made, and their results published in current French scientific journals. Finally his perfected labors found permanent utterance in the *Dictionnaire encyclopédique des sciences médicales*, under the title *Anthropologie de la France;* and this has been separately printed by G. Masson, Paris. The subject is treated under two forms: 1. Ethnologie analytique, ou Étude spéciale de chacune des races ayant concouru à la formation de la population de la France; 2. Ethnologie synthétique, ou Étude générale de l'ensemble de la population de la France considérée dans sa complexité ethnique. — J. W. P. [683

The Indian-office report. — In addition to the mere detail of annuities and reservations, the report of the commissioner of Indian affairs is becoming more and more useful to the anthropologist. The volume for 1882 is, in this respect, the most valuable that has appeared. The report proper, filling eighty-two pages, covers the whole ground of administration, draws attention to abuses, and suggests important reforms. This is followed by a hundred and ninety pages of finely printed digests of correspondence with agents. By carefully running over these letters, one gets here and there some precious bits of information gathered by witnesses on the spot. Indian legislation, government liabilities, directory of agencies, the disbursement of funds, executive orders, catalogues of tribes and reservations, — are all minutely and intelligibly set forth. The report on education includes school population, number and accommodations of boarding and day schools, attendance, cost, native and white teachers, results in the number who can read, and in the acres ploughed, produce raised, and stock owned. The industries taught in each boarding-school are given in each case.

Whole number of Indians	259,632
School population of uncivilized	34,662
Boarding-schools for uncivilized	73
Day-schools " "	105
Boarding-school accommodations of uncivilized	4,903
Day-school " " "	5,299
Average attendance	5,569
Cost to government and religious societies	$355,102
Cost of Carlisle, Hampton, and Forest Grove	$141,276
Number who can read	14,532
Bushels of corn raised	12,713
" " vegetables raised	17,200
School population of five civilized tribes	9,315
Boarding-schools	14
Day-schools	199
Boarding- and day-school accommodations	8,528
Pupils in boarding-schools	1,043
" " day-schools	4,596
Cost to the five nations	$151,950
" " religious societies	$8,089
Number who can read	29,600

A great variety of information respecting population, industries, subsistence, vital and criminal statistics, completes the volume. — J. W. P. [684

Krao, the human nondescript at the Westminster aquarium. — Her appearance and mental condition, and that of her father, are described by A. E. Keane, who holds, that, should the statement in regard to the latter prove true, it would appear that a hairy and straight-eyed race, kindred to the Ainos of Japan, exists in Farther India. — (*Nature*, xxvii. 246.) F. W. T. [685

The Wyoming historical society. — Publication No. 4, of the Wyoming historical and geological society, contains an illustrated description of the finer specimens of Indian earthenware pots in the society's collection. The vessels are of the wide-mouthed variety, like the old dinner-pots, and are equal to any of the same class found in the West. — J. W. P. [686

EGYPTOLOGY.

Pithom - Succoth. — The explorations at Tell-el-Maschuta, carried on under the direction of the eminent Egyptologist, Naville, are yielding further fruit. A statuette of red granite, 65 cm. in height, with inscriptions, contains "the name Pithom (Pa-tum) three times in a form varied from that first found; the name of the god Tum, in Pa-tum, being written ideographically." — "The back bears a laudatory inscription, saying how well this functionary

discharged his duties, and served his king Osorkon II., of the twenty-second dynasty, whose monuments are very rare." — "Several fragments, with portions of the cartouche of Osorkon II." were also found, and "a hawk in red granite more than a metre high, bearing between his claws one of the cartouches of Ramses II., the presumed builder of Pithom." — (*Academy*, March 10.)

One ruin in Egypt has been fully explored. M. Naville, with sufficient funds at hand, has, in less than two months, 'completed the examination of Pithom.' The result has been the identification of the site, and the determination of some geographical and historical problems. Inscriptions in Greek and Latin prove Pithom to have been Hero, 'the storehouse,' and Heroöpolis, 'the store-city.' M. Naville says, "It was Ramses II. who was the founder of the city. He built the storehouse and the temple, but did not finish what he had begun. In the line of the Dromos we find great blocks of granite and of a hard calcareous stone, which had evidently been brought there to make some large tablets or statues, which have been left with marks of the sculptor only. The temple was small, and (the city being chiefly a storehouse and a fortress) had no reason to have many works of art." The Egyptian exploration fund, through the liberality of Sir Erasmus Wilson, has reaped the reward of employing a cool-headed Egyptologist of the first rank, and placing sufficient funds at his command to do his work quickly and thoroughly. — (*Academy*, March 17.) H. O. [687

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Harvard university, Cambridge, Mass.

The chemical laboratory. — During his journey in Europe last year, the director added very materially to the means both of instruction and of research at the laboratory. A dynamo-electrical machine, with an adequate motor, has been placed in the basement of the building. The apparatus required for investigations in the new branch of the science, called thermo-chemistry, has been procured. Several hundred valuable specimens have been added to the mineral cabinet, and placed on exhibition in the cases; and a favorable opportunity enabled the director to procure, at small cost, several thousand characteristic mineral specimens for the use of students. It has been very difficult, hitherto, to procure suitable specimens in sufficient number and variety for the large class in mineralogy; and this want having been thus supplied, the laboratory teaching in this subject will be made more effective.

Museum of comparative zoölogy, Cambridge, Mass.

The Schary collection of fossils. — The most valuable accession received during the past year is the collection of Silurian fossils of Bohemia, brought together by the late J. M. von Schary, which has been purchased from his heirs. This collection is of the greatest value to American paleontologists, as it will give them the means of comparing the types of the great collections which have formed the basis of the works of Barrande and of Hall. Some idea of the magnitude of this collection may be formed from the fact that it contains over a hundred thousand specimens. Of these, probably two-thirds of the collection — no less than 1,231 species, representing 157 genera — are identified.

The Schary collection, taken in connection with those brought together from American localities, now makes the museum collection of paleozoic fossil invertebrates one of the finest in existence.

Peabody museum of American archeology, Cambridge, Mass.

Shellheaps on the coast of Maine. — The material obtained during last summer's explorations of shellheaps on the Damariscotta River and Muscongus Sound, is of special interest. At the heap on Keene's Point, considerable pottery was found, and an unusual number of stone implements. In addition to the ordinary implements made of bone, a harpoon-point was obtained, having two barbs and a perforation, showing that it was attached to a shaft by a string. In another heap, on Hodgdon's Island, Mr. Gamage found a similar perforated point with a single barb. These are believed to be the first specimens of this character from the Atlantic shellheaps; and they are of special interest, from their close resemblance to points from the North-western Coast. Most of the stone implements were rudely chipped forms; but one polished stone celt was found at some depth in the heap at Keene's Point. This deposit consists principally of clam-shells; although the valves of oysters, quahaugs, and scallops, were found, as well as the shells of Buccinum and Natica. Many broken bones of animals were abundant. The most common were those of the deer, moose, and bear; but those of the fox, otter, skunk, beaver, seal, and several other species of mammals, are noted; also the bones of several species of large birds, those of a turtle, and several species of fishes, as the codfish, flounder, devil-fish, and sturgeon. Human bones were obtained from a shellheap on Fort Island; and portions of a human skeleton dug out of the great oyster-heap at Newcastle were secured. A spear-point of bone was found by Mr. Phelps, about one foot below the surface, in the Keene's Point heap; and above it, just under the sod, he found an iron point of nearly the same size and shape, which was probably made out of a piece of hoop iron in imitation of the earlier bone implements. An iron spear and an iron axe of very old form were also found in the shells near the surface of the deposit, which, with a small clay pipe of a kind made in England about the middle of the seventeenth century, found also by Mr. Phelps ten inches deep in the shells, show that this particular deposit was added to by the Indians after contact with the whites, though there can be no doubt that it was commenced long before that time.

State university of Kansas, Lawrence.

Weather report for March. — The temperature, rainfall, cloudiness, and wind-velocity were below the March averages. An occurrence unprecedented in Kansas was the continuous cloudiness of the last eight days of the month, during seven of which the wind did not change from a north-east direction.

Mean temperature, 40.90°, which is 0.90° below the average March temperature of the fifteen preceding years. The highest temperature was 69°, on the 17th and 22d; the lowest was 16°, on the 19th; monthly range, 53°: mean temperature at 7 A.M., 34.84°; at

2 P.M., 48.64°; at 9 P.M., 40.08°. The mercury fell below the freezing-point on thirteen days.

The first blossoms of the white maple (Acer dasycarpum) were observed on the 1st; of the white elm (Ulmus Americanus), on the 8th; and of the dog-tooth violet (Erythronium albidum), on the 23d; these dates being considerably later than usual.

Rainfall, including melted snow, 1.28 inches, which is 0.96 inch below the March average. Rain or snow, or both, fell on eight days, on one of which the amount was too small for measurement. The snow was at no time more than sufficient to whiten the ground. There was one thunder-shower. The entire rainfall for the three months of 1883 now completed has been 4.32 inches, which is 0.39 inch below the average for the same period in the past fifteen years.

Mean cloudiness, 48.92 % of the sky, the month being 0.96 % clearer than usual. Number of clear days (less than one-third cloudy), 13; entirely clear, 4; half-clear (from one to two thirds cloudy), 8; cloudy (more than two-thirds), 10; entirely cloudy, 8: mean cloudiness at 7 A.M., 49.03 %; at 2 P.M., 50.64 %; at 9 P.M., 47.09 %.

Wind: N.E., 30 times; N.W., 24 times: S.W., 23 times; S.E., 7 times; N., 4 times; W., 3 times; E., once; S., once. The entire distance travelled by the wind was 12,080 miles, which is 2,728 below the March average. This gives a mean daily velocity, of 389.68 miles, and a mean hourly velocity of 16.24 miles. The highest velocity was 50 miles an hour, on the 18th.

Mean height of barometer, 29.164 inches; at 7 A.M., 29.181 inches; at 2 P.M., 29.147 inches; at 9 P.M., 29.164 inches; maximum, 29.774 inches, on the 3d; minimum, 28.630 inches, on the 18th; range, 1.144 inches.

Relative humidity: mean for month, 65.6; at 7 A.M., 75.4; at 2 P.M., 49.4; at 9 P.M., 72.0; greatest, 100, on the 24th; least, 21, on the 17th. There was no fog.

NOTES AND NEWS.

— It will be remembered that the great comet of 1882 was first noticed by railroad employees in the Argentine Republic, and that Dr. Gould's attention was called to it as seen Sept. 6. On Sept. 7 it was seen at the Cape of Good Hope and in Australia; and on the 11th, Cruls saw it at Rio, and cabled its discovery. Finally, A. A. Common of London announced its discovery in England on Sept. 17.

By the courtesy of Prof. E. C. Pickering of Harvard college observatory, we are allowed to publish the following translation of a letter from the director of the observatory at Chapultepec to the secretary of state and interior of Mexico, which shows that the comet was seen in Mexico on Sept. 14.

I have the honor to communicate to you, that this day, between five and six in the morning, there has been observed at this observatory, by Felipe Valle, a comet which was seen yesterday by Francisco Toro, an employé of the central meteorological station.

The data which Sr. Valle has been able to collect are the following: the approximate position of the comet was 10h. 30s. right ascension, and 1° 15′ declination south, placing it, consequently, in the constellation Sextans Uraniae, a little below and about half way between α Hydrae and α Leonis (Regulus), with which stars it forms a nearly right-angled triangle. Its nucleus appears as a star of the second magnitude, having a strong resemblance to Mars, both on account of its red color and its brilliancy. The nucleus is separated entirely from the coma, both this and the tail having a transparent yellow color. The tail is 5° to 6° in length. The breadth of the coma is about 1′ 3″, and, of the nucleus, about 40″. The tail has sharply defined edges, and is straight at its origin, but appears to bend further on, with the convex side towards the zenith. The comet appears on the horizon at 5h. 12m., and can be seen by the naked eye up to 5h. 40m.; that is, eight minutes before sunrise; but with the telescope of our altazimuth instrument, using a magnifying power of thirty-nine diameters, it can be seen even fifteen minutes after the sun is up.

I shall give you information in regard to our future observations.

Chapultepec, Sept. 14, 1882.

— The Philosophical society of Washington, at its meeting March 24, listened to an account, by Prof. J. R. Eastman, of the methods and success of the Florida expedition for observation of the transit of Venus, and to an historical and critical review, by Professor Cleveland Abbe, of methods of determining the temperature of the air. A communication from Professor Charles E. Munroe described a method of ascertaining the specific gravity of solids by means of the hydrometer.

— A mathematical section of the Philosophical society of Washington has been formed. At the meeting held March 29, Professor Asaph Hall was elected chairman for the year 1883, and Mr. Henry Farquhar secretary. Mr. Alex. S. Christie read a paper on 'A quasi general differentiation,' which was discussed by Messrs. C. H. Kummell and E. B. Elliott.

— Mr. Albert E. Menke has been elected to the professorship of agriculture and agricultural chemistry in the Kentucky state college.

— The Ohio weather bureau has decided on a set of signals which will be displayed on the sides of the baggage-cars of moving trains. A red sun will indicate higher temperature; star, stationary; and moon, lower. A blue sun, general rain or snow; star, local rain or snow; and moon, clear or fair weather. These signals will be placed, one above the other, on a white ground, and will be as large as the space will allow. It is believed that they can be distinguished at a considerable distance.

— The Boston society of natural history has just issued a list of its officers and members, — the first that has been printed for fifteen years. It shows that its resident membership has fallen in that period from 492 to 422. Women have been admitted to membership, and a new class added of associate members, through which all must pass on their way to corporate membership. In the same way its list of honorary members has fallen from 31 to 20, and of its corresponding members from 228 to 109. The latter lists have clearly been strengthened by the decrease.

— A treatise on projections by Dr. Thomas Craig has been published by the U. S. coast and geodetic survey in a quarto volume of 247 pages.

— Circulars have been issued by the German-Austrian alpine union, calling for contributions in aid of the sufferers from the floods in Tyrol and Carinthia last year. In answer to the first, nearly 40,000 florins were received. Details of the damage caused by the floods are reported by the several sections of the society.

— The highest meteorological observatory in the British Empire has just been organized on the government cinchona plantations in Jamaica. The mean annual rainfall at this particular spot and elevation (4,900 feet) is given as 136 inches, and the mean annual temperature as 60° F. The record of observations will be published in the *Jamaica gazette*.

— Buffalo supports a second scientific society in the Naturalist's field-club, the first (double) number of whose Bulletin is recently issued. Six numbers a year are promised; and if this youthful company of fifty persons, half of either sex, succeeds in filling them with as good material in local natural history as is furnished here, we would wish them all success.

— J. Thomson arrived at Zanzibar Jan. 29, and hopes to complete his preparations for a two-years' trip inland by March 2. He found difficulty in securing porters, as Fischer had taken the best men; but he secured Manya Sera, who had charge of Stanley's party.

— M. Thouar, a French explorer, reports his arrival at Medellin (Antioquia, Colombia) in December last. He goes to Bogota and Quito, and, after a short rest in these cities, will follow the Andes along to Chuquizaca (Sucre), at the head of the Pilcomayo.

— Dillon, French consul at Tientsin, undertook a journey into Mantchuria last January.

— The first two miles of railroad on the upper Senegal, constructed by the French, were opened Dec. 19, 1882, the natives running and shouting after the train as long as they could follow it. Col. Berguis-Desbordes has gone on to Bamaku, on the Niger, where he arrived Feb. 1. On Jan. 16, he burned Daba, whose chief offered the only resistance he met on the way.

— A new Italian expedition, under Bianchi, will go into the interior of Abyssinia with presents to the king, in hopes of obtaining the papers and collections left there by the deceased traveller, Antinori. An attempt will also be made to open a road from Assab to the mountains.

— The section of the Meuse of the Société de géographie de l'est (France) will open a geographic and ethnographic exhibition at Bar-le-Duc, Aug. 20 to Sept. 20, 1883. Besides maps and collections from foreign countries, the exhibit is to contain special studies of the geography of the Meuse; and prizes are offered for the best monographic descriptions of the several communes.

— The Michigan mutual life-insurance company has published a report on the mortuary experience of the company from its organization to Jan. 1, 1882. The methods employed in making their experience-tables is described in detail by the actuary, Mr. M. W. Harrington. It should be noticed, however, that the results make a very favorable showing for the company, possibly due to its comparative youth.

— A. Penck's 'Vergletscherung der deutschen alpen' is carefully reviewed by F. v. Richthofen (*Verh. erdk. Berl.*, 1882, 565–577).

— J. E. Sherrill of the Normal publishing house, Danville, Ind., has in press, for immediate issue, 'Scientific orthography and orthoepy,' by Professor Isaac W. Clinger, Normal school, Charleston, W. Va.

— The Russian department of public works will this year begin the construction of a canal between branches of the Obi and Yenissei, which will, when completed, give water communication from Tumen, near the Ural Mountains, to Kiakta, beyond Baikal, on the Chinese frontier, a distance of more than 1,500 miles in a direct line. Navigation on part of this route lasts only four months.

— The Società geografica italiana has lately issued a volume of notices and proceedings (*notizie e rendiconti*) of the third international geographical congress, held at Venice in September, 1881. A considerable number of pages is occupied with formal addresses, lists of members, awards, and other statistical matters. The reports on certain questions presented to the congress include material of more permanent interest. Among these may be mentioned that of A. Ferrero, recommending the measurement of southern meridian arcs in Australia and the Argentine Republic; Schiaparelli's report on local deflections of gravity, causing differences between astronomical and geodetic latitudes, in one case, near the Alps, between Andrate and Mondovi, amounting to 47″, or one per cent of the total amplitude (singularly enough, the Apennines, in some cases, cause the geodetic to exceed the astronomical latitude); the successful application of photography to topographic work, by Paganini; Magnaghi's hydrographic report, recognizing the superiority of wire-sounding apparatus, and including a classified list of coasts sufficiently or imperfectly surveyed; Uzielli's recommendation of careful measurements to determine horizontal or vertical changes in the relative position of certain points on the land, the causes of such change being found in variations of internal and external pressures in the earth, in contraction of the globe from cooling, in the daily and yearly oscillations from solar heat, shown by Plantamour and Hirsch, in change of composition and density of rocks, and in the underground effects of water. Polar meteorology, ethnography, commercial and historic geography, are also considered. In the geographic exhibition, Italy naturally filled the greatest space; France, Russia, and Germany following it. The objects exhibited numbered 7,042, exceeding those of the Paris geographic exhibition of 1875 by 40 per cent.

The proceedings of the several sectional meetings contain discussions on numerous topics: such as, Egyptian climate, Abbate and Mahmoud Beys contending that there were no signs of its having changed within the past twelve centuries; the formation of coral-reefs by other means than subsidence, as suggested by Semper and Murray, and here maintained by Rein and Fischer; the definition and limitation of scientific geography to the study of the form of the earth's surface, including the manifestations and reciprocal relations of organic forms, with the aid, where necessary, of other sciences, its distinguishing characteristics being the study of position and distribution; the advisability of representing mountain relief and oceanic depression in school-atlases by contour-lines and shades of color rather than by hachures; the exploration of the Mediterranean by Magnaghi and Giglioli, on the 'Washington,' in 1881, their results about Sicily and Sardinia showing a greater variety in the bottom fauna than had been previously found, and an almost uniform temperature of 13.5° to 13° C. at all depths from 800 to 3,634 metres. Three maps are published in this volume. One shows the position of meridian arcs, measured up to 1865, for geodetic purposes (the arc in southern Africa seems accidentally omitted). Another gives the primary triangulation of Europe, showing a wonderful network of accurately determined lines. This, taken with the maps given in our coast-survey reports, and the map of Indian triangulation, reproduced in Markham's 'Indian surveys,' will show about all that has yet been accomplished in this direction. A third plate shows the route of the 'Washington' in 1881. A second volume of acts and communications is promised, in which more extended and valuable reports of scientific papers will be published.

— American entomologists will regret to learn the sudden death of Prof. P. C. Zeller, by heart-disease, at his residence in Grünhof, near Stettin, Prussia, on the 27th of March. He has been known for many decades for his excellent systematic work on Lepidoptera, especially the lower groups, and of late years has contributed memoirs of importance on American forms. He died at the age of seventy-five, and was actively engaged in his favorite studies to the last.

RECENT BOOKS AND PAMPHLETS.

D'Achiardi, A. I metalli, loro minerali e minieri. Milano, 1883. 402 p. 8°.

Allen, Grant, *and others*. Nature studies. By Grant Allen, A. Wilson, Th. Foster, E. Clodd, and R. A. Procter. London, 1883. 322 p. 8°.

Bastian, A. Inselgruppen in Oceanien. Reiseergebnisse und studien. Berlin, 1882. 305 p., 3 taf. 8°.

—— Völkerstämme am Brahmaputra und verwandtschaftliche nachbarn. Reiseergebnisse und studien. Berlin, 1882. 200 p., 2 taf. 8°.

Belgium — Musée royal d'histoire naturelle. Bulletin, tom. i. Bruxelles, *Hayes imp.*, 1882. 6+257 p., 12 pl. 8°.

Braun u. **Heider** — Zur orientirung üb. die frage der elektr. beleuchtung. Wien, 1883. 8°.

Brehm, A. E. 170 chromotafeln zu Brehm's Thierleben, unter leitung der zoologen Dr. Girtauner, Dr. Klunzinger, O. Schmidt und Dr. Taschenberg nach dem leben ausgeführt vom maler O. Winkler. Leipzig, *Bibliographischer institut*, 1883. 17 plates. (To be completed in 10 quarterly parts.)

Brosius et **Koch.** Le Mécanicien de chemins de fer. Édition française par Emile With. *Bernard*, 1882. Illustr. 8°.

Brugsch, Heinr. Thesaurus inscriptionum aegyptiacarum. Altägyptische inschriften, gesammelt, verglichen, übertragen, erklärt und autographiert. I. Abth. A. u. d. T.: Astronomische und astrolog. inschriften altägypt. denkmäler. Leipzig, 1882. 201 p. 4°.

Chavanne, Jos. Afrikas ströme und flüsse. Ein beitrag zur hydrographie des dunklen erdtheils. Mit einer hydrographischen ueberaichtskarte Afrikas. Wien, 1882. 235 p. 8°.

Debus — Veranschaulichung der tag-u. nacht-länge. Schleswig, 1883. Lith. fol. auf pappe gezogen.

Delboeuf, J. Éléments de psychophysique générale et spéciale. Mesure des sensations de lumière et de fatigue. Théorie générale de la sensibilité. Paris, *Baillière*, 1882. 12°.

Duchalais, J. Animaux et insectes nuisibles de la Sologne. Romorantin, 1883. 23 p. 8°.

Emery, C. Formiche raccolte (nelle Isole Canarie) dur. le crociere dell' Yacht Corsaro. Genova, 1883. 5 p. 8°.

Fechner, G. Th. Revision der hauptpunkte der psychophysik. Leipzig, 1882. 440 p. 8°.

Graaf, H. W. de. Sur la construction des organes genitaux des Phalangiens. Essai couronné de la médaille d'or par la faculté des sciences de l'université de Leide. Leiden, 1882. Illustr. 4°.

Great Britain — Geological survey. Memoirs. The geology of the country around Cromer. (Explanation of sheet 68 E.) By Cl. Reid. With notes by H. B. Woodward. London, 1883. 8°.

—— *The same.* The geology of the country between Whitby and Scarborough. (Explanation of ¼ sheet 95 N. W.) By C. Fox-Shangways a. G. Barrow. London, 1883. 8°.

Green, Asa T. 'Eureka,' or the golden gate ajar; the mysteries of the world mysteriously revealed. Cincinnati, *Collins*, 1883. 141 p., illustr., ports. 12°.

Grollet, Camille. L'électricité, ses applications pratiques. Paris, *Degorce-Cadot*, 1882. 12°.

Haeckel, E. Indische reisebriefe. Berlin, 1882. 368 p. 8°.

Haeussler, J. W. Beiträge zur mechanischen wärme theorie, insbesondere die mathematische behandlung der von der wärme geleisteten inneren arbeiten. Leipzig, 1882. 76 p. 8°.

Halke, H. Einleitung in das studium der numismatik. Berlin, 1882. 8°.

Hofmann, A. W. Chemische erinnerungen aus der Berliner vergangenheit. Zwei akademische vorträge. Berlin, 1882. 158 p. 8°.

Hoppe, O. Stammbaum der neuen aufbereitungsanstalt bei Lautenthal. Lith. Clausthal, 1883. f°.

James, Powell W. Guesses at purpose in nature with especial reference to plants. London, 1883. 192 p. 12°.

Japing, E. Die elektrische kraftübertragung u. ihre anwendung in der praxis. Mit besonderer rücksicht auf die fortleitung u. vertheilung d. elektr. stromes. Wien, 1883. 256 p., illustr. 8°.

—— Kupfer u. messing, sowie andere technisch wichtige kupferlegirungen, ihre darstellungsmethoden, eigenschaften, etc. Wien, 1883. 208 p., illustr. 8°.

Kareis, J., u. F. **Bechtold.** Katechismus der eisenbahntelegraphie u. des elektrischen signalwesens. Wien, 1883. 160 p., 15 pl. 8°.

Leenhardt, F. Étude géologique de la région du mont Ventoux. Paris, *Masson*, 1883. 274 p., 4 pl. 4°.

Mission Flatters (II.) — Historique et rapports rédigés au service central des affaires indigènes, avec, documents à l'appui et une carte dressée p. Bernard. (Gouvernement général de l'Algérie.) Alger, 1883. 384 p. 8°.

New York — Geological survey. Natural history of New York. Palaeontology, vol. 5, part 1. Lamellibranchiata. Plates and explanations. Albany, *Van Benthuysen pr.*, 1883. 20 p., 80 pl. 4°.

Pocket logarithms to four places of decimals, including logarithms of numbers and logarithmic sines and tangents to single minutes; to which is added a table of natural sines, tangents, and co-tangents. (Van Nostrand's science series, No. 65.) New York, *Van Nostrand*, 1883. 139 p. 24°.

Preble, G. H. A chronological history of the origin and development of steam navigation, 1543–1882. Philadelphia, 1883. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

AN OPEN LETTER.

TO THE EDUCATED PEOPLE OF THE UNITED STATES.

A few months ago the announcement was made that a company of eminent scientific men was formed for the purpose of establishing in this country a scientific journal of the highest character. The journal proposed was to be called "Science," which well indicates its scope and purpose. It was to be illustrated, and to appear weekly on Fridays. It was to be of convenient size for reading in the library or in travelling-conveyances. It was to be printed handsomely and accurately, and to be of suitable shape to bind into easily handled volumes. Its contents were to be in extreme contrast with the majority of publications of the day. Every line was to be written by a thoroughly competent person, who was to be paid for his work. Not a word was to be inserted that had been influenced by any other cause than pure merit. Not a single "puff" or any kind of notice of any thing was to be printed for money-making purposes. Not an advertisement was ever to be inserted in any but the avowedly advertising pages; and no advertisement was to be inserted on any page if the editor thought best to decline it.

The company chose for its officers and directors: President, Daniel C. Gilman, the president of the Johns Hopkins University; Vice-President, Alex. Graham Bell, the inventor of the Telephone; Othniel C. Marsh, the president of the National Academy of Sciences; Gardiner G. Hubbard, long identified with the postal telegraph movement; and Samuel H. Scudder, the president of the Boston Society of Natural History.

It was proposed to offer to the public a journal which would, during the year, contain fifteen hundred pages of text, and to ask merely a subscription of $5.00; making, in fact, the cheapest scientific publication ever offered. Its contents were to give, in intelligible language, the scientific progress in every department of science in all parts of the world. And, although the requirements of scientific writing in some cases require technical language, every intelligent person can find in every issue a fair proportion of the contents wholly intelligible to him, and all of it of great interest and peculiar value.

It seems, therefore, that the enterprise is worthy of the active and positive encouragement of all the educated people of this country; and as the larger the paper's circulation, the larger will be its sphere of usefulness, we ask of you, first, to subscribe for yourself, and then to try to persuade others also to subscribe. In a short time a very handsome volume will be published, containing a classified list of subscribers to this new journal "Science." If you are not a subscriber already, we should be pleased to receive your subscription at once.

MOSES KING, Publisher,

Harvard Square, Cambridge, Mass.

SCIENCE.

AN ILLUSTRATED JOURNAL, PUBLISHED WEEKLY.

OWNED BY

THE SCIENCE COMPANY.

OFFICERS AND DIRECTORS.

D. C. GILMAN, OF BALTIMORE, *President.*
GARDINER G. HUBBARD, OF WASHINGTON.
ALEX. GRAHAM BELL, OF WASHINGTON, *Vice-President.*
OTHNIEL C. MARSH, OF NEW HAVEN.
SAMUEL H. SCUDDER, OF CAMBRIDGE, *Treasurer.*

SUBSCRIPTIONS.—In United States and Canada, $5 a year.
In Great Britain and Europe, $6 a year.

ADVERTISEMENTS.—Sixty dollars a page, each insertion. Parts of pages in proportion. A discount for several consecutive insertions.

CIRCULATION.—Every week at least six thousand copies.
For the year, about four hundred thousand copies.

MOSES KING, *Publisher*, CAMBRIDGE, MASS.

FRIDAY, APRIL 27, 1883.

NATIONAL ACADEMY OF SCIENCES.

The annual meeting of this body was held in Washington during the last week, with an attendance of forty members. Scientific sessions were held on Tuesday, Wednesday, and Friday, in the large lecture-room of the National museum, and business sessions on every day of the meeting. A list of the papers read appears elsewhere in this issue.

Twenty-four foreign associates were elected, as follows, — *Astronomers:* Professor Otto von Struve of the imperial observatory at Pulkova, Russia; Prof. J. C. Adams of Cambridge, Eng.; Prof. A. Auwers, director of the observatory at Berlin; and Prof. Theo. von Oppolzer, director of the observatory at Vienna. *Mathematicians:* Professor Arthur Cayley of the university of Cambridge, Eng.; Prof. J. J. Sylvester of the Johns Hopkins university, Baltimore; and Prof. E. Bertrand of Paris. *Physicists:* Prof. R. Clausius of the university of Bonn; Baron H. von Helmholtz, professor in the university of Berlin; Professor Robert Kirchoff of the university of Berlin; Prof. G. G. Stokes of the university of Cambridge, Eng.; and Sir William Thomson, professor in the university of Glasgow. *Chemists:* Prof. J. B. Dumas, secretary of the academy of sciences, Paris; and Profs. M. Berthelot, Boussingault, Chevreul, and Würtz, all of Paris. *Geologist:* Freiherr von Richthofen, professor in the university of Bonn, and president of the German geographical society. *Botanists:* Sir J. D. Hooker, director of the botanical gardens at Kew, Eng.; Prof. A. de Candolle of Geneva. *Biologists:* L. Pasteur of Paris; Prof. T. H. Huxley of London; Prof. R. von Virchow of the university of Berlin; A. von Kölliker, professor of anatomy in the university of Würzburg. Professor Struve, one of the newly elected foreign associates, who is on a visit to this country, was a regular attendant at the scientific sessions of the academy, and read a paper.

In consequence of the death of Professor W. B. Rogers, the president, it became necessary to elect his successor. On the first ballot, Professor Wolcott Gibbs of Cambridge, one of the founders of the academy, was elected. He, however, firmly declined the honor, from a feeling, as he said, that he could not give the time necessary to the work. The academy reluctantly acquiesced in the decision of Professor Gibbs, and proceeded to a second ballot, when Professor O. C. Marsh of New Haven, the acting president, was elected by a handsome majority. The newly elected president will hold office for six years.

The first act of the new president was to announce that he had received from Mrs. Mary A. Draper, widow of Professor Henry Draper, the sum of six thousand dollars, accompanied by a deed of trust which fully specified the objects she had in view. He called upon Professor Barker to explain the nature of the trust to the academy. Professor Barker first made some appropriate remarks, recalling Professor Draper's interest in the academy, and then read the deed, the substance of which is as follows: the income of the trust is to be used "for the purpose of striking a gold medal, which shall be called the 'Henry Draper medal,' shall be of the value of two hundred dollars," and shall be awarded from time to time, but not oftener than once in two years, as a premium, to any person in the United States or elsewhere who shall make an original investigation in astronomical physics, the results of which shall be deemed by the academy of sufficient importance and benefit to science to merit such recognition. If at any time the income of the fund shall exceed the amount necessary for the striking of the medal, the surplus may be used in aid of investigations and work in astronomical physics, to be made and carried on by a citizen of the United States.

The president appointed Messrs. G. F. Barker, W. Gibbs, S. Newcomb, A. W. Wright, and C. A. Young, as a committee to have charge of the fund, to make rules to govern the award of the medal, and to suggest to the academy for approval the names of those who may be considered worthy of the award.

The treasurer announced, that, in accordance with the will of the late Professor James C.

Watson, the sum of about fourteen thousand dollars had been placed in his hands. When the estate is finally closed, a further sum will be paid over to the academy. The income of the Watson fund is to be used, under the direction of three trustees, — Messrs. J. E. Hilgard, S. Newcomb, and J. H. C. Coffin, — for the purpose of aiding astronomical researches. In accordance with the recommendation of the trustees, the academy granted five hundred dollars from this fund, towards defraying the expenses involved in observations of the total solar eclipse of May 6, 1883.

Later in the meeting, Professor Simon Newcomb of Washington was elected vice-president, and Professor Asaph Hall of Washington, home secretary. Five new members were elected: Professor A. Graham Bell of Washington; Dr. J. S. Billings, U.S.A., of the U.S. army medical museum, Washington; G. K. Gilbert, of the U. S. geological survey; H. B. Hill and C. L. Jackson, professors of chemistry in Harvard college. The whole number of members is now ninety-five.

On the afternoon of Thursday the academy adjourned to take part, by invitation, in the ceremonies attending the unveiling of the statue of Professor Henry in the grounds of the Smithsonian institution. The time for these ceremonies was purposely fixed to coincide with that of the spring meeting of the academy. Henry was pre-eminently a scientific man, and, at the time of his death, president of the academy; and yet the members of the academy were placed far down the line in the procession, — after the commissioners of the District of Columbia, and after officers of the army and navy. This fact must be regarded as evidence of a lack of appreciation of the relations existing between Henry and the academy, and of the true worth and dignity of science.

The exercises, which were in good taste, began with a short address by Chief-justice Waite. After this, at a signal, the covering was quickly drawn aside, instantly revealing the entire statue. Loud applause followed, those who were seated rose to their feet, and all hats were removed. The scene was highly impressive; and when the philharmonic society, accompanied by the full marine band, burst forth with Haydn's grand chorus, 'The heavens are telling,' the heart must have been a hardened one which did not experience a feeling of exaltation.

In the opinion of all, the statue is dignified and pleasing, and vividly calls to mind the honored original. President Porter's oration, which was the principal event of the afternoon, was listened to with much interest. It dealt with the plain facts of the life of Henry, and was all that his best friends could have desired.

Among the pleasantest social features of the meeting was a reception given to the members of the academy on Thursday evening by Prof. A. Graham Bell. There were present many well-known gentlemen, among them, Gen. Sherman, Chief-justice Waite, Senator Sherman, ex-Secretary Blaine, and the Japanese, Swedish, and Belgian ambassadors.

THE DECAY OF ROCKS GEOLOGICALLY CONSIDERED.[1]

THE author, in this paper, presented in a connected form the principal facts in the history of the decay both of crystalline silicated rocks, and of limestones or carbonated rocks, by atmospheric agencies. Having first discussed the chemistry of the process, he noticed the production of spheroidal masses, or so-called bowlders of decomposition, by the decay and exfoliation of massive rocks. He then proceeded to show that the process of decay is not, as some have supposed, a rapid or a local one, dependent on modern conditions of climate, but that, on the contrary, it is universal, and of great antiquity, going back into very early geological periods. These conclusions were supported by details of many observations among paleozoic stratified and eruptive rocks in the St. Lawrence valley, as well as among eozoic rocks in the Atlantic belt, as seen in Hoosac Mountain, in the South Mountain, and in the Blue Ridge. In connection with the latter he described the decay, not only of the crystalline strata, but of their enclosed masses of pyritous ores, and the attendant phenom-

[1] Abstract of a paper read by T. STERRY HUNT, LL.D., F.R.S., before the National academy of sciences at its meeting in Washington, April, 1883.

ena. The decay of the primal and auroral strata of the Appalachian valley, and the formation therein of clays and of iron and manganese oxides, was also discussed. The pre-Cambrian antiquity of the process of decay in the eozoic rocks of the Mississippi valley, as shown by Pumpelly and by Irving, as well as similar evidence from Europe, was noted, while the more recent decomposition seen in the auriferous gravels of California was described and explained.

The final removal of the covering of decayed rock from many northern regions during the drift period was then considered; and the thesis advanced by the speaker in 1873, that the decay of rocks "is an indispensable preliminary to glacial and erosive action, which removed previously softened materials," was discussed in its relations to bowlders, glacial drift, and the contour of glaciated regions. Pumpelly's development and extension of this doctrine to wind-erosion was noticed, and also the recent comparative studies of Reusch in Norway and in Corsica, in which similar views are enforced.

The principal points in the paper, as reviewed at its close, are as follows: —

1. The evidence afforded by recent geological studies in America and elsewhere, of the universality and the antiquity of the subaerial decay, both of crystalline silicated rocks and of calcareous rocks, and of its great extent in pre-Cambrian times.

2. The fact that the materials resulting from such decay are preserved *in situ*, in regions where they have been protected from denudation by overlying strata, alike of Cambrian and of more recent periods; or, in the absence of these, by the position of the decayed rock with reference to denuding agents, as in driftless regions, or in places sheltered from erosion, as within the St. Lawrence and Appalachian valleys.

3. That this process of decay, though continuous through later geological ages, has, under ordinary conditions, been insignificant in amount since the glacial period, for the reason that the time which has since elapsed is small when compared with previous periods; and also, probably, on account of changed atmospheric conditions in the later time.

4. That this process of decay has furnished the material, not only for the clays, sands, and iron oxides from the beginning of paleozoic time to the present, but also for the corresponding rocks of eozoic time, which have been formed from the older rocks by the more or less complete loss of protoxide bases. The bases thus separated from crystalline silicated rocks have been the source, directly or indirectly, of all limestones and carbonated rocks, and have, moreover, caused profound secular changes in the composition of the ocean's water. The decomposition of sulphuretted ores in the eozoic rocks has given rise to oxidized iron ores *in situ*, and to rich copper deposits in various geological periods.

5. That the rounded masses of crystalline rocks, left in the process of decay, constitute not only the bowlders of the drift, but, judging from analogy, the similar masses in conglomerates of various ages, going back to eozoic times; and that not only the forms of such detached masses, but the surface-outlines of eroded regions of crystalline rocks, were determined by the preceding process of subaerial decay of these rocks.

THE ORIGIN OF CROSS-VALLEYS.

I.

DR. FR. LÖWL of Prague contributes an interesting article on *Die Entstehung der Durchbruchsthäler* to a recent number of *Petermann's mittheilungen* (1882, 405–416), and comes to the conclusion that transverse valleys or water-gaps are never formed by the persevering action of an antecedent or pre-existing river on a slowly rising mountain fold or fault. "Erosion can, under no circumstances, keep pace with mountain folding" (409). Cross-valleys are then accounted for in two other ways, — first, occasionally by erosion at the outlet or point of overflow of the lake formed behind the rising mountain barrier; second, and so frequently as to constitute the general method, by backward erosion at the head of a lateral valley, which finally cuts through the ridge separating two longitudinal valleys, and allows the higher to drain across into the lower, so that in a folded mountain system of great age the original order of drainage on the longitudinal valleys is often entirely effaced (411). Several carefully examined cases of this kind are described for the eastern Alps and elsewhere. The question does not arise now whether these examples are correctly determined: presumably those to which sufficient local study was given are decided safely enough; for this backward origin of certain gorges is eminently possible. The question is rather, whether nearly all cross-valleys are of this ancestry, and whether the antecedent valley nowhere exists. We consider Löwl's affirmative answer to this question essentially incorrect, and believe that his

error of result comes from an error of method of but too prevalent a kind; namely, the assumption that things of a single geographic name are to be accounted for by a single physical or geological cause. Geographical nomenclature is in no condition to allow such an assumption; for no science has so loose, inaccurate, and insufficient a terminology as geography. Not a few examples could be given of errors arising from this *one-name, one-cause* idea. Until it is proved that two phenomena are closely alike in their several characters, an explanation of the origin of one will not necessarily apply to the other; and for this reason, in our present ignorance of the structure and form of many regions otherwise comparatively well known, it is not safe to extend local explanations over too broad a field.

Löwl rejects the possibility of a river's holding its course across a rising mountain fold; because the several examples discussed in his paper, chiefly those rivers on the northern slope of the Alps which are temporarily warped into lakes, have failed in doing so (408, 409). To this it might be answered, that these lakes are perhaps formed by a local depression of the valley-way, rather than by a local uplift at their outlets, and, moreover, that they constitute such an 'ephemeral phase in the river's history' as hardly to constitute a serious argument toward a decision. The temporary formation of a lake behind the growing fold, afterward drained by the victory of the river, is not sufficient ground for excluding the valley from the antecedent species, though it might serve for the marking of a variety. But even admitting the correctness of this conclusion for the Swiss rivers, it proves nothing for the rivers that escape from other mountain ranges. The success of the river depends on the proper relation of two variable factors, — the rate of its erosion, and the rate of the mountain's growth; and these may have such different relative values, — as determined by rainfall, drainage area, altitude, distance to the sea, mountain-making force, composition and attitude of the rocks, — that the predetermination of the result is impossible. Nothing short of close local study will serve to answer the question with any approach to certainty; and it therefore seems best to trust the Indian surveyors in their explanation of the Sutlej[1] gorge, and our own geologists in their reports on the rivers they have examined in the western territories. Concentrated erosion can keep pace with mountain folding, and antecedent valleys are often preserved.

Reference is made to the several transverse valleys of the Delaware, Potomac, and Susquehanna in the Appalachians (407), with the conclusion that they cannot be explained as antecedent valleys.[1] In spite of the many observers devoted to the study of the Appalachians in the past fifty years, there is yet no good topographic map of any large part of them, and much remains to be done in explaining their geological structure. It is still rather early to write their history; but we do not believe that the objections raised by Löwl to the antecedent character of their larger valleys are conclusive. The theory of these valleys, so far as it can be now stated, should, of course, be led by the facts so far as they are now known; and, in the writer's mind, the facts lead directly to the theory that the valleys are antecedent. The question is made clearer if we consider first the case of the rivers in Tennessee and south-western Virginia that rise in the archaean mountains of North Carolina, — the Great Kanawha and the Tennessee. The first of these follows the direction of slope that must have prevailed through all paleozoic time, in running from the old crystalline mountains, north-westerly, across the strata derived from their waste. We must conclude that the growth of the great post-carboniferous folds and faults on its course were insufficient to turn it into a north-eastward or south-westward channel. It flows along a true antecedent valley; and our notions of the rates of mountain growth and river erosion should conform to the fact of its existence. The Tennessee also finally makes its way to the north-west; but none of its branches that rise in the North Carolina mountains succeeded in crossing all the folds and faults that grew in front of them. Although they all made their way through some of these barriers, they were sometimes turned to the south-west; and not until they were united in great volume could they escape to the north-west at Chattanooga, and again at Claysville, Ala. This shows a river greatly embarrassed by the difficulties that arose in its way. Most of its branches failed, and were turned aside into consequent longitudinal valleys; but some suc-

[1] Hardly recognizable in its modern Germanized form, *Satladsch*. The German transliteration of the valuable English consonant, j, is very cumbersome. Witness *Udschidschi*.

[1] Löwl does not detect a misquotation by Tietze, whose valuable *Bemerkungen über die bildung von querthälern* (*Jahrb. geol. reichsanst.* 1878, 581-610) he endeavors to controvert. Tietze states (600), that, according to Dana, the Appalachians grew by addition of parallel folds on the eastern or seaward side. Löwl quotes Credner to prove the opposite order of growth, but Dana also said just the reverse. See *Amer. journ. sc.*, iii. 1847, 183.

ceeded, and these survive in the existent water-gaps. There can be little doubt that lakes very frequently appeared and disappeared on these stream-courses during the growth of the mountains.

THE INTELLIGENCE OF FISH.

In Mr. Romanes's recent volume on Animal intelligence,[1] only thirteen pages are devoted to the intelligence of fish. That this class of animals is more 'knowing' than is generally believed, is, I hold, unquestionable. From frequent conversations with old fishermen, I have learned that the exercise of cunning, on the part of fish, is by no means uncommon; and I have also found that certain sayings are common among these people, such as 'cute as an eel,' 'sly as a snippick,' i.e., snipe-pike (Belone truncata), which also show that fish are credited with considerable intelligence by these practical observers, whether rightfully or not. My own impression, based upon long-continued, careful study of our fish, long since fully convinced me that many of them were possessed of nearly as much intelligence as birds, and more than either the snakes or batrachians. This may seem a hasty statement, but I believe it is substantially correct. For this reason, I am surprised that so little has been recorded by observers, with reference to fish, as is evident from the meagre array of facts presented by Mr. Romanes in the work mentioned. The author, in the opening remarks of his chapter on fish, says, "Neither in its instincts nor in general intelligence can any fish be compared with an ant or a bee." This statement I propose to dispute, because there is abundant evidence that the intelligence of fish varies exceedingly, and some fish do possess an amount of cunning which brings them nearer to the ants or bees than Mr. Romanes's remark would imply. Had our author said 'most fish,' perhaps no exception could have been taken to the statement; but, using the words 'any fish,' he is, I think, open to criticism.

But what are the evidences that some fish possess such an amount of intelligence as I have intimated? In reply, I have to offer a case of great cunning shown by a number of pike when in danger of capture. A gilling-net had been placed across the outlet of a small tributary of Popihacka Creek. In this little spring-brook several large pike had wandered in search of minnows. Being disturbed, they rushed with great impetuosity towards the net, and the foremost of them was at once securely entangled in its meshes. Straightway the others stopped as suddenly as they had started, and, recognizing their fellow in trouble, 'took in the situation' at once. Each pike evidently realized the true condition of affairs, and reasoned thus: that pike tried to go through this obstacle in the water, and is in trouble; it is necessary for me to avoid it by some other means. There were five of these fish that paused close to the net; and each acted, I believe, as it *thought* best. One of them came to the surface, and, after a moment's pause, turned upon one side, and leaped over the cork-line. Seeing the success of this effort on the part of one, a second did the same. A third came to the shore near where I stood, and, discovering a narrow space between the brail and the net, passed very slowly through, as though feeling its way, although the water was so shallow that its body was fully one-third out of the water as it did so. The others were either more timid or less cunning. They turned to go up stream; but being met by my companion, who was making a great noise by whipping the water, they rushed again towards the net, but checked their course when their noses touched the fatal net. Prompt action was necessary. They had not confidence in their leaping-powers; and both, as though struck with the same thought at the same moment, sank suddenly to the bottom of the stream, and burrowed into the sand and beneath the lead line, which was in full view. In a moment they reappeared on the other side of the net, and were gone. I could have prevented the escape of all of these fish, but was so much interested in the evidence of thought exhibited by them, that the idea of molesting them did not occur to me. There was something in the manner of these fish, too, which is not readily described, but which gave an importance to those acts, on their parts, that I have mentioned, and which added materially to the strength of the evidence that they were 'thinking' in all that they did.

Evidence of the intelligence of fish is further shown by our common sunfish (Eupomotis aureus), which not only mates early in the spring, and guards its nest and young until the latter are able to shift for themselves, but in many cases remains paired. If it can be said of storks, that marriage occurs among them, the same is true of sunfish. I have known the same pair to occupy for several years the well-protected space bounded by the twisted roots of an enormous maple, that

[1] Animal intelligence. By George J. Romanes. — (*Internat. sc. ser.*, no. xliv.) New York, *Appleton & Co.*

projected into the water. In this case, and I know of many others, these fish plainly showed the existence of strong mutual affection. Indeed, when once the nest is formed, a pair of young sunfish, mated but for the single season, are evidently very fond of each other; and, if one of them is caught, the other is straightway stricken with grief, which it shows by unmistakable signs. Grief is, of necessity, a true mental operation. It cannot be referred to instinct, as defined by Mr. Romanes; and that sunfish are grief-stricken when deprived of their mates is unquestionable. It is only necessary to take one from the nest, and let it nearly die by exposure to the atmosphere: then replace it, and watch the actions of the other. No one will, I think, hesitate to consider as grief the emotion that controls the fish thus deprived of its mate.

The common catfish (Amiurus catus) likewise exhibits great affection for its young, which remain with the parent-fish for several weeks after they are hatched. She does not, indeed, always succeed in keeping her brood together; but, so long as she does, she will defend them from all enemies, without regard to her own safety. I once placed a glass globe containing a brood of young catfish on the bank of the stream from which they were taken, and in full view of the parent-fish, which was greatly excited by being deprived of her charge. This fish at once recognized that her young were not in the creek, although they were swimming in water. After a variety of restless movements, its curiosity overcame its discretion; and it left the creek, and, as best it could, made its way to the base of the globe containing her young, a distance of about two feet. Here she remained for nine minutes, quietly watching her brood, and then returned to the water. In a few moments she returned, having recovered from the effects of exposure to the air. I now liberated the young catfish; and they immediately clustered about their parent, and followed her into deep water. In this case the parent-fish made no effort to escape when I approached, and allowed me to handle her without any resistance. I have since tried similar experiments with these fish, and always with essentially the same results.

Instances, also, might be multiplied indefinitely of actions, on the part of fish, indicative of cunning or forethought, — cunning in their efforts to secure their prey, forethought in their efforts to escape their enemies. I have even seen ingenuity exercised by a roach, notoriously the most stupid of fish. Space, however, will not permit of further details. Let it suffice to mention, that the actions of predatory fish in hunting in schools, and those of comparatively helpless fish (such as the cyprinoids) in keeping together in large companies, that collectively they may lessen individual danger, are cases that exhibit evidence of a realization of the fact that in union there is strength. The predatory fish know, that, by concerted action, their prey can be more readily captured. Those that are exposed to attack know, that, as one in a thousand, the chances of each of escaping its foes are greater than if it wandered solitary and alone.

The very fact that our fish vary greatly in their habits is, of itself, evidence that they differ in their intellectual capacities; those that are solitary being the quicker witted, and the more prompt to adopt some ingenious device to meet the requirements of the moment. Witness, in this regard, the pike, the black bass, the etheostomoids, the mud-minnow (Umbra). In these we have instances of fish that clearly demonstrate the possession of a considerable range of intelligence. On the other hand, watch the distracted schools of cyprinoids chased by rock-fish or perch. It is seldom that they do more than trust to luck; and these fish are never seen except associated in large numbers.

Nor must the fact that many fish, as the mud-sunfish (Acantharcus pomotis), eel, catfish, and chub-sucker (Erymizon sucetta), have well-defined vocal powers be overlooked; for it, too, has a bearing on the subject of the intelligence of fishes, in that the circumstances under which these vocal powers are exercised are such as indicate that they are intended to convey ideas to others of their kind, — an act which necessitates a complicated mental effort.

After years of familiarity with the many species of fish found in the Delaware River and its tributaries, I find that they can only be intelligibly described by using such terms as 'cunning,' 'fear,' 'grief,' 'ingenuity,' and 'anger;' and if their actions unquestionably indicate the possession of such emotions and faculties, — and I claim that they do, — then the great gulf, mentioned by Mr. Romanes, between the intelligence of fish and that of ants and bees, is materially lessened; and future studies of the much-neglected subject of the habits of fish will, I believe, ultimately show that many fish are the intellectual equals of any existing insects.

Chas. C. Abbott, M.D.

ACTIVE JAPANESE VOLCANOES.[1]

THE following list of Japanese volcanoes contains only those which are either active now, or of which records of eruptions exist, or which have evidently been active in recent times, as shown by their solfataras. The number of extinct cones is not known: especially is this the case in Yesso.

The number of known volcanoes in the Kurile Islands is 52 (of these, 12 are active); in Yesso and adjacent islands 19 (active 12); in Hondo, Kiushiu, and adjacent islands, 60 (active 24). In all there are 131, of which 48 are active. These figures are somewhat different from those ordinarily stated. The latitudes given do not claim any great accuracy, but are put in to give an approximate idea of the positions: they are taken from the best Japanese maps. The names Yama, San, Take, Nobori, are synonymes of mountain.

The active volcanoes are most numerous between 138° and 140° E. long. and the parallels 32° and 38°. It is therefore not strange that Tokio, situated within these limits, should have experienced 377 earthquake-shocks in the five years from 1876 to 1881. Dr. C. GOTTSCHE.

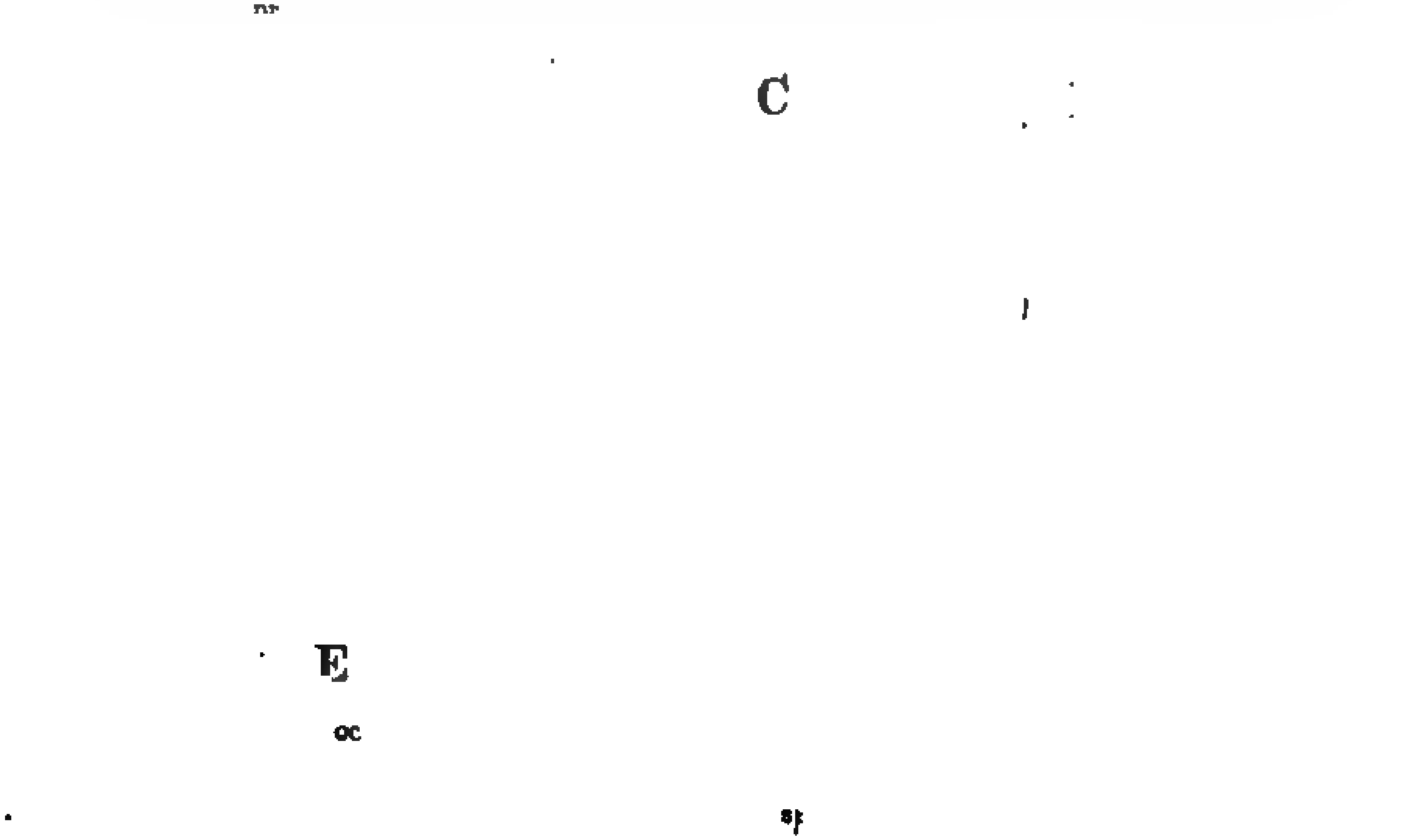
LIST OF JAPANESE VOLCANOES IN ACTIVITY.

No.	North lat.	Name.	A number here refers to date of last eruption.	Corresponding names of other authors.
		a. Kurile Islands.		
1	50° 54′	Alaid.	1793.	
2	50° 45′	Mount Ebeko, } on Poromushir.	Smoking in 1877.	
3	50° 15′	Fusspeak,	1793.	
4	48° 53′	Mount Simnarka, on Shiaskotan.	1855.	
5	48° 16′	Raikoku.	? 1780.	
6	48° 6′	Sarytschew, on Matua.		
7	46° 29′	Chirnoi.		
8	46°	Urup.	Smoking, according to	
9	45° 30′	Moshisinayama, } on Iturup.	Krusenstern, Langs-	
10	45° 20′	Rebunshirinobori,	dorf, Lütke.	
11	44° 30′	Chachatake, } on Kunashir.		
12	44° 3′	Lousaoyama,		
		b. Yesso and adjacent islands.		
13	44°	Itashibeoni.	Solfatara.	Iwaosan.
14	43° 20′	Menkan.	Solfat.	
15	43° 3′	Yoichitake.	Smoking in 1878.	Yatsunai.
16	42° 55′	Iwanainobori.	Solfat.	Iwaosan, Iwaotake, Iwaonobori.
17	42° 40′	Tarumaitake.	1874.	Aiyama.
18	42° 40′	Usutake.	Solfat.	
19	42° 35′	Nuburibetsutake.	Solfat.	
20	42° 5′	Komagatake.	1856.	Sawaratake.
21	41° 50′	Esanyama.	Solfat.	Uchiura.
22	45° 11′	Riishiri.	Solfat.	Pic de l'Angle.
23	41° 31′	Oshima.	Smoking.	
24	41° 21′	Koshima.	Smoking.	
		c. Mainland (Hondo).		
25	41° 20′	Yakeyama.	Active within historical	Osorisan.
26	40° 37′	Iwakiyama.	time, according to Jap-	Tsugaru-no-fuji, Pic Tilesius.
27	39° 7′	Chokaisan.	anese authors.	
28	39° 50′	Ganjusan.	Solfat.	Iwateyama, Iwawasiyama.
29	37° 7′	Nazuyama.	Solfat.	
30	36° 50′	Shiraneyama, near Nikko.	1873.	
31	36° 40′	Shiranesan, near Kusatsu.	1882.	Kusatsuyama.
32	36° 35′	Tateyama.	Solfat.	
33	36° 22′	Asamayama.	1867.	
34	36° 8′	Hakusan.	? 1554.	Shirayama, Koshi-no-Shirayama.
35	35° 21′	Fujisan.	1708.	Fuji-no-yama, Fusiyama.
36	35° 16′	Hakoneyama.	Solfat.	
		d. Islands south of Hondo.		
37	34° 42′	Miharayama, on Oshima.	Active.	(Oshima = Vries Island.)
38	34° 15′	Kodzushima.	Within historical time.	Kamidzu.
39	34° 7′	Otokoyama, on Miyakeshima.	1874.	Nanahiroyama.
40	33° 7′	Hachijo.	? 16th century.	Fatsitzio.
41	32° 34′	Aogashima.	Within historical time.	
		e. Kiushiu, and islands south-west of Kiushiu.		
42	32° 45′	Asoyama.	1874.	
43	32° 44′	Unzengatake.	1793.	
44	31° 45′	Kirishimayama.	Solfat.	
45	31° 33′	Mitake, on Sakurajima.	1828.	
46	30° 45′	Iwoshima.	Active.	Iwogashima.
47	29° 39′	Suwaseshima.	Solfat.	Suwashima.
48	27° 51′	Torishima.	Solfat.	Iwoshima.

[1] Extract from a letter dated Tokio, Jan. 12, 1883, communicated by Professor Jules Marcou.

LIFE-HISTORY OF THE LIVER-FLUKE.

PROF. A. P. THOMAS, now of Auckland, New Zealand, has published in full the results of his valuable and important researches on the development of the liver-parasites, which produce the so-called 'rot,' —a disease that is especially fatal to sheep, but sometimes occurs in man. It is estimated to have occasioned the loss of some 3,000,000 sheep in Great Britain during the winter of 1879–80. Leuckart has also studied this subject, and reported his observations in the *Zoologischen anzeiger* for Oct. 9, 1882. Thomas's results, as given in the *Quarterly journal of microscopical science* for January, 1883, are remarkably complete; and, as they are of general interest, we present an abstract of them.



EXPLANATION OF FIGURES. — A, embryo; B, sporocyst; C, redia; D, cercaria; E, young sporocyst; F, cystogenous cell; G, pod cell from cercaria. *oc*, ocelli; *sp*, spores; *R*, redia; *ph*, pharynx; *g*, collar of redia; *c*, cystogenous cells; *s*, sucker.

The adult worm (Distomum hepaticum) infests the liver of mammals. It discharges its eggs into the bile-ducts, which they sometimes clog. The eggs then pass into the intestines, and may be found abundantly in the droppings of the host. The number of eggs emitted by a single fluke may be safely estimated at several hundred thousands. Segmentation of the ovum occurs in the body of the host; but the further development being dependent on a lower temperature than that of the mammalian body, and on moisture, can proceed only after the eggs are discharged. 23°–26° C. is most favorable, the embryo being formed in about three weeks. At a lower temperature, the development is prolonged; but, under the same conditions, the individual eggs vary enormously as to the time needed to produce the embryos: hence a field once infested remains dangerous for a long time. The embryo enlarges at the expense of the nutritive material (so-called *yolk-cells*, though they have nothing to do with the yolk), and, when mature, bursts open the operculum of the egg-shell, and immediately begins swimming freely in the water. Its form is an elongated cone (0.13 mm. long), with rounded apex, as is shown in fig. A of the accompanying cut. The base of the cone is directed forwards, and in its centre is a short retractile head-papilla, *pr*. The whole surface is covered with cilia, which are borne by the large ectodermal cells. In the interior are *two* eyes, *oc*, and other structures, which are very briefly described, and call for further study. The embryo is exceedingly active, swimming about like an infusorian, though more rapidly. When it meets a Lymnaeus truncatulus (a common snail), its first host, it presses the head-papilla against the surface of the snail, and begins spinning around its axis, and working its body, until the tissues of the snail are forced apart, leaving a gap through which the embryo squeezes its way into its host. The embryo appears to have some means of instinctively recognizing the truncatulus, for it does not attack other species. It cannot live much more than about twelve hours in water, and it usually gets into a snail within eight hours.

In the snail it changes into a sporocyst, which, during warm summer weather, may reach its full size within a fortnight; but in autumn twice that time

may be necessary. The outer ciliated cells swell up, and are finally cast off. The embryo then becomes an elliptical cyst, the pigmented eye-spots being still preserved, fig. E. The cyst grows and elongates. The body is then covered by an external cuticle, under which is a sparse musculature, followed by an epithelium, which lines the cavity, and forms the greater part of the thickness of the body-walls. The author gives some further structural details. Sometimes, but less frequently than in other species, these sporocysts multiply by transverse division, effected by a gradually deepening constriction about the middle of the body.

The next larval forms, the rediae, are developed within the sporocyst. The cells, which each give rise to a redia, are in part soon present in the embryo; but they increase later by proliferation of the cells lining the cavity of the sporocyst. The first clearly recognized appearance of the rediae is as a morula-like cluster of cells, which soon assumes the gastrula form. An external membrane appears, and, later, a pharynx. There are several germs in each cyst, usually one redia (less frequently two) nearly ready to leave the sporocyst, with two or three germs of medium size, and several small ones, fig. B. When ready to leave the cyst, the redia, by its own motions, makes a forcible exit by rupturing the walls of the sporocyst. The free rediae force their way through the tissues of the host, and are found especially in the liver. They increase in length to 1.3 mm. or 1.6 mm., fig. C; a collar, *q*, being formed, meanwhile, a little behind the pharynx. In other respects, except the possession of a digestive tract, the rediae resemble the sporocysts in structure. They are, however, more muscular, and present other differences, which the author describes. There is present a distinct birth-opening at the side of the body, a little behind the collar, which permits the exit of the brood from within the redia. The germs, *sp*, develop similarly to those of the sporocysts, but are more numerous. Sometimes they form rediae, and sometimes cercariae; yet the early stages of the spores are the same in either case. A germinal cell, forming part of the internal lining of the posterior end of the body-segments, forms a morula. A gastrula enlarges, and gradually assumes a shape that reveals whether it shall become another redia, or a cercaria. There may be as many as twenty-three spores in various stages of development in one redia. It is probably the temperature which determines whether rediae or cercariae are produced; since the former are produced during the warm, the latter during the cold months.

The development of the cercariae, the next form in the series, takes place, as we have seen, in the redia. As the oval enterate spore increases in size, it assumes a more elongated shape; whilst one end becomes more attenuated than the other, and finally is constricted off to form the tail. The thicker portion becomes the body proper, and in it are developed the bifurcate intestine and other organs. Certain cells, F, later develop into the organs for secreting the cyst; and many of the cells in the body of the cercaria are crowded with most remarkable rod-shaped bodies, G, closely resembling bacteria in size and shape, reaching a length of 0.006 mm. In an adult redia, with a brood of twenty or so, there will be one, two, or three cercariae approaching complete development.

As soon as the cercaria has reached the limit of development within the redia, it escapes from the parent by the birth-opening. When free, D, the cercaria is very active, and constantly changes its form. Its most striking characteristic is the presence of the cystogenous cells, D, *c*, before mentioned. These are large, and so crowded with coarse, highly refractile granules as to be rendered quite opaque, F. They are arranged in two-lobed masses, extending along each side of the body, and connected together just in front of the ventral sucker.

By the aid of its suckers, *o* and *s*, and tail, the tadpole-shaped cercaria crawls or wriggles its way out of its host. When the infested snails are kept in an aquarium, the cercariae may occasionally be found swimming about in the water, but not long; for, on coming in contact with the side of the aquarium or the water-plants, it proceeds to encyst itself. The process can be readily observed under the microscope; for, on a glass slide, the cercaria soon comes to rest. It assumes a rounded form; whilst a mucous substance is poured forth all over the body, together with the granules of the cystogenous cells. The tail is shaken off either before or during encystation, which is completed in a few minutes. These cysts are the means of infecting the final vertebrate host of the parasites; the infection being rendered possible by the habits of the intermediate host, Limnaeus truncatulus, which might well be termed amphibious, so strongly is its habit of wandering on land developed. Indeed, they can remain on land for long periods, and resist even prolonged droughts: hence, when in the water, the snails become infested, and, when on land, leave the cercariae that crawl out of their first host scattered over the fields, where they encyst on the grass, and are eaten by the sheep and other animals.

In the stomach the cyst is dissolved, leaving the worm free. The worm then makes its way into the liver, and probably in about six weeks begins to produce eggs, growing meanwhile. During its growth its external form changes, the simple forked intestine develops many coeca, the posterior sucker is greatly enlarged, and the sexual organs are matured. Thereafter, the wondrous cycle of metamorphoses and emigration recommences with the new eggs. There are, perhaps, no other instances more striking, of the adaptation of animal species to particular conditions of existence, than we find in histories of such parasites as the trematode worms, of which we have narrated one life-history. CHARLES S. MINOT.

FLUORINE MINERALS.

P. GROTH has carefully reviewed (*Zeitschr. kryst.*, vii. 457) the following minerals, mostly from Greenland: —

Pachnolite. — This is shown to be entirely distinct from thomsenolite. The pure crystals were submitted to J. Brandl for analysis, who found that they corresponded closely to the formula $NaF \cdot CaF_2 \cdot AlF_3$. It is distinguished from thomsenolite by its absence of water, and has arisen from the analogous mineral cryolite by the substitution of a calcium atom for two atoms of sodium. Heated in the closed tube, the mineral decrepitates violently, covering the sides of the tube with a white powder. The crystals are monoclinic. Almost all show the form of slender prisms, the largest from 2 to 3 mm. long, and 0.5 mm. thick, terminated at one end by an apparently rhombic pyramid, and at the other by two basal planes making a very obtuse angle with one another, showing the twin nature of the crystals. The twinning plane is parallel to the ortho-pinacoid; and the two halves are so equally developed that the two hemi-pyramids appear above like a very perfect rhombic pyramid. The prismatic faces are finely striated in

a horizontal direction. The axial relation $a : b : c = 1.1626 : 1 : 1.5320$. $\beta = 89° 40'$.

Thomsenolite. — This mineral occurs in far greater quantity than pachnolite. Its chemical composition, from analysis by J. Brandl, is $Na\,F \cdot Ca\,F_2 \cdot Al\,F_3 \cdot H_2O$. Heated in the closed tube, it decrepitates violently, giving off acid water. The axial relation $a : b : c = .9959 : 1 : 1.0887$. $\beta = 89° 37\frac{1}{2}'$. Besides the perfect basal cleavage with mother-of-pearl lustre, a second cleavage parallel to the prism was observed. The habit of the crystals is prismatic, the prism striated horizontally.

Ralstonite. — This mineral occurs crystallized in isometric octahedrons; and thus far its constituents have been determined by a qualitative analysis made on a very small quantity, and one imperfect analysis, showing it to be a fluoride of aluminium, magnesium, calcium, and sodium, with water. Carefully selected material, submitted to analysis by J. Brandl, gave the following : F (57.12) . Al (22.14) . Na (5.50) . Ca (1.53) . Mg (3.56) . H_2O (10) = 99.85, corresponding to the formula, $3\,(Na_2Mg\,Ca)\,F_2 \cdot 8\,Al\,F_3 \cdot 6\,H_2O$. The mineral occurs intimately associated with the thomsenolite.

Chiolite. — This is a tetragonal mineral, resembling cryolite, occurring in the Ilmen Mountains, with axial relation $a : c = 1 : 1.0418$. It seldom occurs in well-developed crystals; and, when so, the crystals are small. Occasionally it is met with in snow-white clusters composed of an aggregate of minute crystals. The various older analyses of the mineral vary very considerably; and a new analysis, by J. Brandl, gives the following result: F (57.30) . Al (17.66) . Na (24.97) = 99.93, corresponding to the formula, $5\,Na\,F \cdot 3\,Al\,F_3$.

Arksutite. — This mineral, which has for a long time been regarded as a distinct species, is shown to be based upon an incorrect analysis, and is probably nothing more than a mixture of cryolite with pachnolite.

Fluellite. — This mineral, which is one of the rarest, is known in the form of minute sharp rhombic pyramids, occurring with wavellite and other minerals from Cornwall. With great trouble .12 gram was obtained quite pure for analysis. This gave J. Brandl the following: F (56.25) . Al (27.62) . Na (0.56) [H_2O (15.55)] = 100. This agrees closely with the simple formula, $Al\,F_3 \cdot H_2O$.

Prosopit. — This rare mineral, found at Altenberg, Saxony, but not since 1866, occurs mostly altered into kaolin, in some cases the crystals having a core of unaltered material within them, while a few are wholly unaltered. The crystals, while they have been converted into kaolin, have retained their form most perfectly. The crystals are monoclinic, with the axial relation $a : b : c = 1.318 : 1 : 0.5912$. $\beta = 86° 2'$. Pure material gave J. Brandl, upon analysis, F (35.01) . Al (23.37) . Ca (16.19) . Mg (0.11) . Na (0.33) . H_2O (12.41) . loss regarded as oxygen (12.58) = 100, corresponding to the formula, $Ca\,Al_2\,(F, O\,H)_8$, in which fluorine and hydroxyl are isomorphous.

S. L. PENFIELD.

COLOR AND ASSIMILATION.

A NEW method of measuring the effect of rays of different degrees of refrangibility upon the assimilative activity of vegetable cells has been recently devised by Th. W. Engelmann of Utrecht. It will be seen that the method is simple, and probably of wide applicability. It consists in the use of a few uninjured cells, — for instance, of some filamentous alga, — placed in water which contains bacteria. If oxygen is evolved from the cells, as in assimilation, the bacteria, which up to that time may have been quiescent, become extremely active, and the activity is greatest close to the assimilating cells. If light be now withdrawn, the supply of oxygen is soon exhausted, and the bacteria again become quiet, resuming their activity as soon as the slightest trace of free oxygen is accessible to them. By their presence it is possible to detect, according to Engelmann, the one trillionth of a milligram of oxygen.

Supposing a long filament of some alga is thus arranged under the microscope, and light passes through the slide, the character of the light is seen at once to have a very marked effect upon the movements of the bacteria. If the light has first been passed through a direct-vision spectroscope placed *under* the stage of the microscope, so that the filament lies in the length of the spectrum thus produced, the bacteria are seen to cluster immediately in certain parts of the spectrum, to the exclusion of the others; and the inference is not unfairly drawn, that they go where oxygen is most abundant. To the facts thus presented in an earlier paper, Engelmann adds, in the *Botanische zeitung* (Jan. 5 and 12, 1883), some curious observations regarding the assimilative power possessed by vegetable cells of different colors. In brief, his results are the following: only those cells which contain chlorophyll or its equivalent in the protoplasmic body have any power of evolving oxygen; a colorless cell, or one which has coloring-matter only in the cell-sap, cannot evolve oxygen under the influence of any rays of light. This has a direct bearing upon the so-called 'screen' theory of Pringsheim, according to which the pigment acts only as a screen to diminish the otherwise too intense effect of light. It may be stated that Pringsheim suggested, that, by passing through a thin layer of solution of chlorophyll-pigment, the light would be so tempered as to bring about assimilation in colorless protoplasm. Engelmann shows that this is not likely to happen under any conditions of screening.

Furthermore, in experimenting upon algae of different colors, he found that the assimilative activity is not in the same part of the spectrum for all cells. For instance: the greatest activity for red cells is in the green; for green cells, in the red; for bluish green, in the yellow; and, for yellowish brown, in the green and red; or, *in general, in the color that is almost or completely complementary to the color of the cell.* To state this in another form, it may be said that the rays of the spectrum which effect the work of assimilation are identical with those which are absorbed by the chlorophylline coloring-matter.

It may be added that a large number of Engelmann's experiments were made by the use of Edison's lamp. In *Pflüger's archiv* for Jan. 10, the same author has a paper on a bacterium which he has found to be extremely sensitive to light, and which has been named B. photometricum. There are a few points in that communication which are not wholly in harmony with the facts stated above; but, as they are of minor consequence, they may be passed over now without further mention. GEO. L. GOODALE.

LARVAL STAGES AND HABITS OF THE BEE-FLY HIRMONEURA.

NOTHING is yet known of the first larval stage of the bee-flies. I have expressed the belief that future observation would show that there is a parallel between the Meloids and the Bombyliids, in that the first or newly-hatched larva of the latter would differ from the clumsy, partially parasitic, full-grown larva,

by being more active, and somewhat different in structure (*Rep. U. S. ent. comm.*, ii. 267). Mr. Adam Handlirsch of Vienna has recently published[1] a most interesting account of the life-history of the European Hirmoneura obscura Meigen, which tends to

Fig. 1. — *a, a, a*, females ovipositing in burrows of Anthaxia; *b*, eggs at bottom of burrow. Natural size. (After Brauer.)

confirm this opinion. Hirmoneura is the only genus we have in the United States belonging to the Nemestrinidae, — a family so closely allied to the Bombyliidae, that Mr. Handlirsch's observations are of especial interest in this connection. I condense from it the following facts, and borrow the chief figures illustrating them.

Herr Handlirsch first succeeded, in July, in observing the act of oviposition; the female fly inserting her ovipositor deeply into the old burrows of small wood-boring insects (probably Anthaxia) in a pine fence surrounding a pasture. The eggs, laid in clusters, were actually found within these burrows. Upon investigation, however, it was found that the fence-rails did not contain galleries sufficiently large to have been made by the Hirmoneura larvae; but hundreds of its pupae and pupa skins were discovered in the pasture, protruding from the ground, and mostly held upright by their terminal hooks. Male and female flies were also observed issuing from these pupae; while, in the ground under the pupae, the exuviae of the full-grown Hirmoneura larvae were, in every instance, found at a depth of about one-half decimetre. Still deeper were found the remains of the pupa of a large-sized lamellicorn beetle, which proved to be the common' Rhizotragus solstitialis. In one instance Mr. Handlirsch also found the full-grown Hirmoneura larva just issuing from the abdomen of the Rhizotragus pupa. Finally he succeeded in following up the early history of the young larvae. They issued in great numbers from the aforementioned burrows in the pine fence, and, placing themselves in an upright position at the entrance of the burrows, allowed themselves to be blown away by the wind. They have so far not been followed from this point to full growth as a parasite on the pupa of the Rhizotragus; and some interesting facts yet remain to be discovered. The newly-hatched larvae can live a long time without food, as one of them, hatched on Aug. 17, was kept in confinement until Oct. 29.

But the most interesting point in connection with these discoveries is the structure of the young larvae. It is unnecessary to enter into the descriptive details given by Mr. Handlirsch. I merely wish to point out, that the young Hirmoneura larva is distinguished from the full-grown larva by its slender form, somewhat different structure of the mouth-parts, but principally by the presence of ventral pseudopods bearing long and hooked setae. Joints 6–12 are each provided with one pair of these pseudopods, bearing a stout seta hooked at tip, with the hook pointing backward; while the thirteenth joint bears two pairs of similar setae, but with the hooks directed forward, thus assisting the larva in taking a firm hold, and in assuming an erect position. There is no trace of these setae in the full-grown larva, which strongly resembles those I have figured of the Bombyliids.

It is probable that this young Hirmoneura larva moves quite readily by the aid of these ventral appendages, and that it clings to the female Rhizotragus, and

Fig. 2. — Newly-hatched larva, greatly enlarged. (After Handlirsch.)

is carried into the ground by her when she enters the same to oviposit; and it is highly probable that the newly-hatched Bombyliid larva has similar organs that facilitate locomotion. I am inclined to believe that the hooked setae of Hirmoneura would rather impede than facilitate burrowing, and that they perform rather the same service as the tarsal ungues and anal spinneret of those Meloid triungulins which fasten to burrowing-bees in order to be carried where

[1] Die metamorphose und lebensweise von Hirmoneura obscura Meig., einem vertreter der dipterenfamilie Nemestrinidae. — (*Wien ent. zeit.*, 1882, 224–228, 1883, 11–15, tab. 1.) See also Dr. Fr. Brauer's Ergänzende bemerkungen, etc — (*Ibid*, 1883, 25, 26.)

they will find their food-supply, and opportunity to develop. In this view of the matter, the development of such non-homologous parts for analogous purposes is of great morphological interest. The analogy with the young Meloïds will doubtless be found to go still farther, in that the young Bombyliid

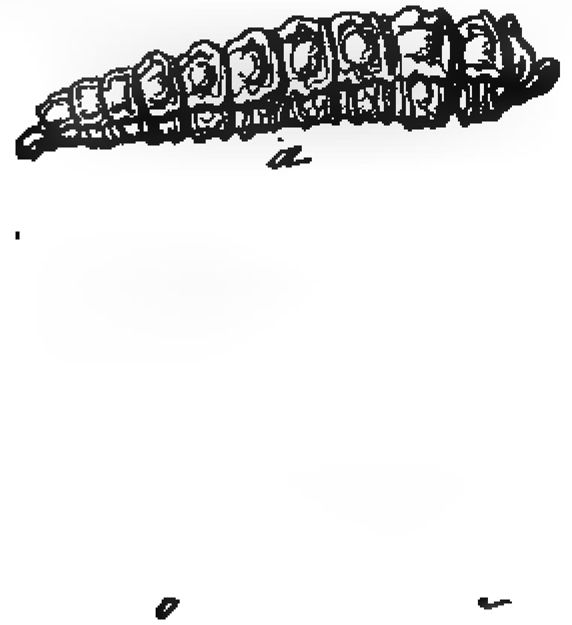


FIG. 8. — *a*, full-grown larva; *b*, pupa-shell; *c*, larva issuing from pupa of Rhizotragus. (After Handlirsch.)

will hibernate and otherwise live for a long time without food, waiting patiently for the hatching and growth of its intended victim, which growth may be very rapid among lamellicorns and pectinicorns, as I have shown in the case of Passalus cornutus (*5 Mo. ent. rep.*, 55), in which full larval development from the egg requires but six weeks. C. V. RILEY.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

The Lake-Superior rocks.

IN SCIENCE for Feb. 9, Mr. Selwyn refers to what he regards a 'mistake' of mine, in quoting him as believing that the trap and sandstone of Lake Superior are of the age of the Huronian. The statement was made on the authority of his report for 1877–78, p. 14 A., where, in his general classification, he has placed in the Huronian "the typical or original Huronian of Lake Superior, and the conformably — or unconformably, as the case may be — overlying upper copper-bearing rocks." I could not, of course, in 1881, state what Mr. Selwyn may believe in 1883, regarding the trap and sandstone of Lake Superior. A fair inspection of the Tenth annual report of the Minnesota survey, which he criticises, would have shown him that that opinion was quoted from him in 1877–78, since his report for that year is given as authority for the statement on the following page. Still, I am very glad to be re-enforced in the views which I have advocated in my reports since 1872, first promulgated by Messrs. Foster and Whitney, by the distinguished authority of the director of the Canadian survey. I concur with him in the sweeping affirmation, "that there is, at present, no evidence whatever of their holding any other place in the geological series" than that of the 'Potsdam and primordial Silurian;' and I would also add, that there is much incontestible evidence that they *can hold no other*.

In SCIENCE for March 9, Mr. Irving has misquoted and misrepresented my views in three respects: 1. That I have *strenuously refused* to believe in the unconformability of the sandstone and trap at Taylor's Falls in the St. Croix valley; 2. That, after my visit to the valley in 1881, I *confess to the unconformity;* and, 3. That I have *argued a difference of age* between the 'eastern sandstone' of the south shore of Lake Superior, and that of the St. Croix valley.

In respect to the first of these, it is only necessary to refer to the First report of the Minnesota survey (p. 69, 70), where the unconformity of the St. Croix sandstone on the trap and sandstones is made a strong point in the argument for separating the two under different names.

Secondly, I should hardly regard that a 'confession,' in 1881, which is the same that I advocated in 1872, and, in the interim, on all suitable occasions.

Thirdly, as to the difference of age between the sandstones of the St. Croix valley and those of the eastern southern shore of Lake Superior, probably Mr. Irving has misapprehended my argument in the Tenth report, Minnesota survey. Instead of ranking them of different age, I have grouped them as of the same age (p. 134), and call special attention to the fact, that the late investigations of Dr. Rominger, as well as the paleontological discriminations of Mr. Billings, go to show their identity. I have, however, a strong inclination to concur with Mr. Irving in the opinion that the 'Animikie group' of Thunder Bay is the equivalent of the original Huronian, and have already expressed reasons for such a supposition (Tenth report, p. 95). Some further examination in the northern part of Minnesota is still necessary to establish the parallelism. N. H. WINCHELL.

Minneapolis, Minn., April 2.

Venturesome spiders.

In the summer of 1882, while engaged for the U. S. coast and geodetic survey in the triangulation of New Hampshire, I witnessed an exhibition of tight-rope, or perhaps I ought to say slack-rope, performance, that somewhat surprised me at the time, and which may, perhaps, be of interest to your readers. It was upon the summit of one of our New-Hampshire hills, some 1,400 feet above sea-level, bearing the name of Blue Job. The air was clear, and the sky partially overcast with cumuli clouds, with a very light breeze from the east. After completing a series of measurements upon an angle, I stepped for a moment to the western side of my observatory (a small wooden structure, with shutters opening breast-high for observation); and, standing near the north-western corner of the building, I observed, starting out suddenly, and at almost the same instant, three spiders, each spinning out his single thread as he went, lying, back downwards, upon nothing but the air, and sailing off at an angle of, perhaps, 10° to 15° above the horizon, as if bound to some other sphere. The rate of motion was not more than a third or half metre per second; and as the air was very clear, and I soon had the advantage of a bright cloud for a background, I was able to watch the dark specks for a long distance. One of them made a partial failure, if his object was a long voyage, for he came to the ground within ten or fifteen metres; while the other two went on and up as far as the unaided eye could follow them, or perhaps I should say one of them did, for at last I was obliged to relinquish one, to be sure of holding the other in view. The distance to which the one was followed could not have been, I think, less than fifty metres.

The question arises, How did they do it? They went, it is true, in the direction of the wind, what there was of it; but this was so light that I judged at

the time there was not wind enough to do more than to swing the spider to the same angle from the vertical that he was then making above the horizon. It seemed the more surprising, as the spiders were large, and ought, by all the laws of gravity, to have fallen to the earth at once. And what was their objective point, aiming, as they did, for the clouds and stars? But I content myself with the statement of the facts, leaving to others the how, why, and whither.

E. T. QUIMBY.

Hanover, N.H.

Improvement of western pasture-land.

In his article in SCIENCE, p. 186, Professor Shaler's opening sentence, "that the greater part of the United States west of the meridian of Omaha is unfit for tillage," leaves a somewhat wrong impression. The greater part of Nebraska is west of that meridian; but nearly the whole state, as far as longitude 99°, produces crops of the cereal grains, grasses, corn, fruit, and roots, more surely, even, than the middle states. This area embraces 30,000 square miles. Large sections west of the 99th meridian produce almost equally well, as our statistics show. His suggestions, however, apply to the proper management of the grasses outside of this area, and are of very great importance.

A remarkable peculiarity of our Nebraska flora is its changing character. While not confined to the grasses, it is especially conspicuous among them. When I first crossed this county (Lancaster) in 1865, buffalo-grass (Buchloe dactyloides) covered much of the uplands. By 1871 nearly all of this species had disappeared; and its place was taken by blue-joints (Andropogon furcatus, etc.), interspersed with Bouteelouas, Sorghum nutans, Sporobolus, etc. Again, in 1878, the blue-joints disappeared from entire townships, and the Boutelouas usurped their place. Similar phenomena were observed in almost every county in the state, and even in sections where settlements had not penetrated. During the last two years Sorghum nutans has been gaining in eastern Nebraska over all other species. On the whole, the species indigenous to moist regions have been gaining on the buffalo-grasses to such an extent that the latter have almost entirely disappeared east of the 100th meridian, and from large areas farther west. In extreme north-western Nebraska, on tributaries of the Niobrara, I have observed, since 1865, a remarkable exchange of buffalo-grass for Boutelouas and other grasses in different years. This tendency, therefore, is common, though not to the same extent, in the drier as well as the moister portions of the state. When old Fort Calhoun, above Omaha, was occupied by the military, twenty-five years ago, Kentucky blue-grass was brought in baled hay to that post from the south. It spontaneously took root, and spread in every direction, and now it can be found on prairies thirty miles away. Many of our farmers in eastern Nebraska are looking to that species now for a grass to give late fall and early spring pasturage.

Under favorable conditions, the wild native grasses produce a remarkable amount of hay. The blue-joints range in productiveness from one to three tons and more per acre. The latter large yield has been realized even at the 99th meridian on the wide Elkhorn-river bottoms. All the facts noted in the moist as well as dry sections of the state confirm Professor Shaler's theory; namely, that the natural conditions on the plains are most favorable to a changing grass vegetation, and that it is possible, through the agency of man, greatly to improve on the native species.

SAMUEL AUGHEY.

Apparent attractions and repulsions of small floating bodies.

As I thought it worth while, in the interests of clear teaching, to object (SCIENCE, i. p. 43) to certain things in Professor John Leconte's explanation of the 'Apparent attractions and repulsions of small floating bodies,'[1] it seems my duty, now that Professor Leconte has replied (SCIENCE, i. p. 240) to my criticism, to justify that criticism, or, failing in that, to acknowledge my error.

A statement in his explanation of the behavior of two moistened floating bodies, to which I particularly objected, was the following: "But when brought so near that their meniscuses join each other, the radius of curvature of the united, intervening, concave meniscus . . . is less than that of the exterior concave meniscuses, . . . and its superior tension acts upon both bodies toward a common centre of concavity."

The parts omitted from this sentence are merely references to a diagram. Professor Leconte now states that he should have said *superior force* instead of *superior tension*. I, however, objected to the statement on quite other grounds. After quoting it, I said, "We do not think physicists generally will admit that a liquid film tends *to draw a solid, to which it is attached, toward the centre of concavity of the film*. Indeed, if this were so, the tendency of a column of water raised between two floating bodies by surface-tension would be to lift those bodies. Similarly, a column of liquid sustained in a fine tube would tend to lift the tube."

I have quoted myself thus at length, — using italics, which I did not use before, — because Professor Leconte appears to understand me as denying that what he calls the 'capillary forces' — such, for instance, as the force exerted upon the enclosed air by the film of a soap-bubble — are directed toward the centre of concavity of the film. I spoke merely of the force exerted upon *the body to which the edge of the film is attached;* and the force exerted by the film upon such a body is certainly not directed toward the centre of concavity of the film. If we coil a rope round a cask, and set a man to pull at each end of the rope, the pressure on the cask will be everywhere directed toward the centre of curvature of the coil: but the pull on the men will not be toward the centre of curvature of the coil; it will be tangential to the coil. In the same way, the action of a meniscus upon the water beneath it, or the air above it, is directed toward the centre of concavity of the meniscus; but the action of the meniscus upon the body to which it is attached is tangential to the liquid surface, and perpendicular to the bounding edge of the meniscus.

Professor Leconte, however, has chosen to make the statement I have quoted above; and to my criticism thereon he replies, "Indeed, it is obvious that the elastic reaction of the common meniscus, formed when two such floating bodies are brought near to one another, *does not tend to lift them;* for the *vertical* component of the capillary forces, directed toward the centre of concavity, is exactly counterbalanced by the weight of the adhering liquid elevated between them, while the *horizontal* component is free to draw them together." He makes a similar statement concerning the action in a capillary tube.

It is, indeed, obvious, that the weight of the water must be sustained; but how and where is this weight applied to the floating bodies or to the tube? If it is applied by means of the surface-film, and at the line where the bounding edge of that film meets the floating bodies, or the wall of the tube, Professor Leconte's

[1] Amer. journ. sc., December, 1882.

final statement of the case of two floating bodies apparently comes to this: that the concave meniscus "acts upon both bodies toward a common centre of concavity," and also exerts upon these bodies a vertical downward force equal to the weight of the water sustained. If this is Professor Leconte's conception of the case, I do not feel to blame for not understanding him at first.

If, on the other hand, he supposes the weight of the water to be applied to the floating bodies, not by means of the surface-film, but in some other manner, it was, I submit, incumbent upon him to explain how and where he supposed it applied.

So much in explanation and support of my criticism of Professor Leconte's original statement. It is now, perhaps, worth while to examine a little further his final statement, as quoted above, beginning, "Indeed, it is obvious." Does not this statement, taken in connection with his first statement, also quoted above, lead directly to the conclusion that he supposes a column of water may be sustained between two bodies by capillary action without exerting any *resultant* downward force upon these bodies? — that, in short, the water is pulled *up* without any resultant tendency to pull the bodies *down?*

I have written thus at great length, and with perhaps unnecessary statement of elementary principles, because I intend this letter to be final upon my part.

EDWIN H. HALL.

Harvard college, Cambridge, Mass.

THE INDIANA GEOLOGICAL REPORT.

Indiana: department of geology and natural history. Eleventh annual report (1881). John Collett, state geologist. Indianapolis, *State*, 1882. 401 p., 55 pl. 8°.

THIS volume contains some interesting scientific and economic matter, partly original, but largely in the form of useful reprints of things not accessible to the people whose needs it is meant to serve.

There is, in the first place, the report of a well-made inquiry into the transverse strength and elasticity of building-stones, principally of the excellent oolite of the St. Louis division of the sub-carboniferous limestones. The point is well made, that the resistance of hammered blocks of stone to compressive strains is very much less than that of sawed masses, owing to the unseen disintegration of the mass produced by the blows of the hammer. There is also the noteworthy suggestion, that the modulus of resistance to compression may be approximately estimated by the 'ring' of the mass when struck.

There are several county reports which have no general value. They contain some venturous discussions of the extremely difficult problems connected with the work of the last glacial period in the Ohio valley. Glacial rivers, glacial lakes, ice-fronts, and all the other machinery of that time, are handled with charming ease and dexterity. We only hope the observers will work past this first transparent stage of the inquiry, and find how beyond imagination hard is this task of explaining the work of the ice-time, and how useless are such vague conjectures unfortified by the amplest delineation of facts.

In the report of Mr. Collett on Shelby county, we find the very interesting statement, that, in several wells sunk in one part of this county, heated waters have been struck within fifty feet of the surface. Nothing is given concerning the amount of flow of these waters or their chemical composition, nor are we told any thing concerning the goodness of the thermometers with which the observations were made, — all very important points. We only have the statement that the water was not potable, and that its temperature was as high as 86° F. As this district is below the level of the carboniferous series, it may not be reasonable to suppose that the temperature is due to the decomposition of iron pyrite, the only considerable known sources of that mineral available in this district being in the coal-measures. It is perhaps more probable that the temperature is due to downward penetration and return of water in a system of faults, which we must suppose to extend to a great depth, though they do not manifest themselves on the surface. If the waters are highly sulphurous, the origin of the heat in the decomposition of pyrite is the most probable; if they are not sulphurous, their source must be sought in faults. The question merits a careful study.

Two hundred pages of the text, and thirty-two of the plates, are reprints of James Hall's Waldron fossils, with some emendations, including four new plates.

Dr. Charles A. White gives a series of plates and descriptions of fossils from the collection of Mr. J. W. Van Cleve. Hall's monograph is well known to but few. It was originally published in the twenty-eighth report of that mysterious body corporate, the regents of the university of New York. This is the first publication of it that could have been of any use to Indianian students.

The species described by Dr. White are chiefly corals, and are not regarded by the author as new species. This part of the work is essentially of local interest. All the species have been better set forth before, but never in a form so accessible for the dweller in the rural parts of Indiana.

Although there is not much that is original in this book, it very likely has a higher measure of utility for the people who pay for it than many a survey report that has better served the purposes of pure science. The old

day when the advance of American geology seemed to depend on state surveys is passing, and will soon pass away. They did good skirmish-work, and deserve to be remembered for many gifts to science; but the problems in scientific geology are now too large to be solved within the limits of a state. Scarce a state in this country has a question that can be properly considered from work done within its limits alone. In the future the state surveys can find their best place, not in efforts to develop general scientific problems, but rather in economic questions, which can always be localized, and in the work of bringing to the notice of the people whom they serve such matters of pure science as may naturally concern them. Other forms of research would better be left to the general government surveys, or to the studies of independent geologists.

It is now pretty well ascertained that our states are unwilling to support permanent scientific establishments on such a scale as will enable them to do good scientific work, but they will pay some one or two men to keep a sharp lookout for any utilities that may be discovered. Fortunately nature so mingles the 'utile' and the 'dulce,' that some good to science will come out of this care for profit, which is to be in the future the task of the state surveyor.

M. HERMITE'S LECTURES.

Cours de M. Hermite, professé pendant le 2e semestre 1881–82. Redigé par M. ANOYER, *élève de l'École normale supérieure. Second tirage revu par* M. HERMITE (*Librarie scientifique*). Paris, *A. Hermann*, 1883.

THIS work of M. Hermite fills, in great part, a decided gap in mathematical literature, and affords a means to American mathematical students, at least, of overcoming a difficulty that of late has become rather serious. With the exception of those who have had the opportunity of listening to the lectures of Hermite or Weierstrass on the theory of functions of a complex variable, all students interested in that subject must have experienced a great deal of difficulty in reading the more modern memoirs which deal with it. Some such book as Durége's, or Neumann's, on Riemann's theory, is very much wanted on what may, with propriety, be called the Weierstrass-Hermite theory of functions. The necessity for such a treatise is steadily increasing, as any one will readily see by looking over the last few volumes of *Crelle-Borchardt*, the *Mathematische annalen*, the *Annali di matematica*, or the two numbers which have already appeared of *Mittag-Leffler's acta mathematica.* The present work by M. Hermite does not profess to be such a treatise. In fact, it is not a treatise at all, but, as its title implies, simply the course of lectures given at the Sorbonne by M. Hermite, and treating of quite an extended list of subjects. The principal topics discussed are the quadrature and rectification of curves, the determination of the areas and volumes of curved surface, the general theory of functions of a complex variable, and the application of this theory to the study of the Eulerian integrals and the elliptic functions.

The first five chapters are devoted to geometry, and contain applications which are chosen with a view to what is contained in the succeeding chapters. Since, for the rectification of conics and the quadrature of plane cubics, it is necessary to consider integrals of the form $\int f(xy)\,dx$, where $f(xy)$ is a rational function of x and y, and y is the square root of a quartic function of x, the author takes up this general integral, and gives Legendre's reduction to the normal forms of the elliptic integrals, and also some of Tchebychef's results concerning the cases where the elliptic integrals are reducible to algebraico-logarithmic functions.

The next three chapters are taken up with an exposition of the more elementary properties of functions of a complex variable, the author giving an account of Darboux's investigations relatively to the integral $\int_a^b F(x) f(x)\,dx$, where $F(x)$ is, between the limits, always positive, $f(x)$ is a continuous function of the form $\phi(x) + i\,\psi(x)$, and where a and b are real. Another method, due to Weierstrass, for integrals of this nature, is also indicated.

In the next four chapters the immediate consequences of Cauchy's theorem are developed, and an account given of Weierstrass's and Mittag-Leffler's investigations in the theory of uniform functions, including their decomposition of a holomorphic function into prime factors, and their general expression for a uniform function with an infinite number of poles, or of essential singular points, the last being due almost solely to Mittag-Leffler.

The next three chapters deal with the Eulerian integrals, and include Prym's expression for $\Gamma(x)$, and Weierstrass's expression for $\frac{1}{\Gamma(x)}$, and a demonstration by M. Hermite of Laplace's formula for the approximate calculation of $\Gamma(x)$, where x is a very large integer.

The next two chapters refer to functions which are discontinuous along a line, — Appell's and Tannery's series, and Poincarré's example of a function having an *espace lacunaire*. As preliminary to Cauchy's theorem concerning the number of roots of a polynomial contained in the interior of a contour, the expression is given by a line-integral of roots of an equation contained within a given contour. Then follows Cauchy's theorem, the establishment of Lagrange's series, Eisenstein's theorem upon series whose co-efficients are commensurable, and which satisfy an algebraical equation, and the enunciation of Tchebychef's theorem upon series with rational co-efficients, which may represent functions composed of algebraic, logarithmic, and exponential functions.

The next chapter treats of multiform functions arising from the integration of uniform and of multiform functions, and of the means of reducing them to uniform functions by systems of cuts (*coupures*).

The remaining five chapters treat entirely of the doubly-periodic functions. After first showing the multiple values of the elliptic integrals of the first kind which correspond to the different paths traced out by the variable, and establishing the double periodicity of the inverse functions to this integral, he defines a function, $\Phi(x)$, which conducts to the analytical expressions for the doubly-periodic functions. The function $\Phi(x)$ is defined by the equations, —

$$\Phi(x + a) = \Phi(x)$$
$$\Phi(x + b) = \Phi(x) \exp.\left[-\frac{ki\pi b}{a}(2x + b)\right],$$

where k is an integer. Then follows the investigation of the elliptic functions, including, of course, Jacobi's Θ, H, and Z functions, the definition of Weierstrass's functions, Appell's expression for doubly-periodic uniform functions in the case where they possess essential singular points, and, finally, a demonstration by M. Goursat of Fuch's theorem concerning the definite integrals K and K', considered as functions of the modulus.

It is perhaps to be somewhat regretted that the book is lithographed instead of printed in the usual manner; but this is of comparatively little consequence, as the writing is very clear and legible. Thanks are certainly due to M. Andoyer, the editor, for the trouble which he must have taken in elaborating what would seem to have been merely a set of notes on M. Hermite's lectures. The whole matter has been revised by M. Hermite, and the aggregate result of his and M. Andoyer's labors is a book which is a decided acquisition to mathematical literature. It is to be hoped that M. Hermite will see fit to go more fully into the subject of the functions of a complex variable, and that of elliptic functions, at a future time, and give to the world a treatise which will be more satisfactory than even the present very valuable work.

T. CRAIG.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

New measures of Saturn's rings. — O. Struve gives the results of a series of measurements of the rings of Saturn at Pulkowa during August and September, 1882, compared with a similar series, also taken by himself, with the same instrument, and at the same time of the year in 1851. In a memoir on the subject in 1851, he seeks to prove, that, while the outer diameter of the rings remains constant, the inner is continually shortening, basing his conclusions on the observations and drawings from Huygens's time. If the conclusion were correct, and the contraction constant, the measures of 1882 should have given a perceptibly shorter inner diameter than those of 1851. The inner diameter of the dark ring seems to be slightly shorter than in 1851, but the difference is not nearly so large as the theory calls for. The dark ring seems, however, to have changed since 1851. Then it seemed divided by a dark streak, the inner part being entirely separate from the bright ring. In 1882, all trace of this division had disappeared, and the dark ring seemed to be merely a faint continuation of the bright ring. — (*Astr. nachr.*, No. 2498.) M. MCN. [688

Formation of the tails of comets. — Mr. Rumford suggests that the repulsive force which is unmistakably manifested in the formation of comets' tails may be due, not to any electric action, or any imagined impulse of solar radiations, but merely to evaporation. A small particle from which evaporation is taking place on the side next the sun will be driven backward with a velocity continually accelerated; and, when more than half of the mass of the particle has been evaporated, the velocity of the residue may be much greater than the average velocity with which the gaseous molecules are driven off from the heated body. In the case of hydrogen at a temperature of 70° or 80° F., the velocity thus acquired might be greater than a hundred thousand miles a day. If we suppose the evaporating material to be gases which have been liquefied by the cold of space (carbon dioxide and volatile hydrocarbons), it becomes easy to account for a powerful repulsive action at distances from the sun even much greater than that of the earth. The writer suggests that the comet's light may be in part due to the 'bombardment' of precipitated particles by the evaporated molecules in the condition called by Crookes 'the fourth state of matter'; so that, "without electrical discharges,

the whole phenomena of the continuous and bright line spectrum in the neighborhood of the nucleus may be accounted for." He also discusses briefly some of the polarization phenomena of comets, and the envelopes which appear near the nucleus. The article is a very interesting and suggestive one; but in view of the fact that comets' tails sometimes grow, not a hundred thousand, but more than a million miles a day, it is doubtful whether the proposed hypothesis can be regarded as sufficient. — (*Astr. reg.*, March.) C. A. Y. [689

GEODESY.

Altitude of Lake Constance. — Part of the work laid out by the European geodetic commission consists in carrying an accurate series of levels across the country, and a share of this has recently been completed by the royal Prussian geodetic institute. It is published as the *Gradmessungs-nivellement zwischen Swinemünde und Konstanz*, by W. Seibt (Berlin, 1882), and records the altitudes of a large number of points from the Baltic, where the datum plane is the mean water-level from fifty-four years' observations, to Lake Constance, where connection is made with the Swiss triangulation. The railway station in Constance is 399.990 met. above the Baltic. — (*Verh. ges. f. erdk.*, Berlin, 1882, 514, 538.) W. M. D. [690

MATHEMATICS.

Symmetric functions. — Previous mention has been made of Mr. Durfee's tables for the twelfthic. By a curious coincidence, M. Rehorovsky of Prague has, almost simultaneously with Mr. Durfee, computed the same tables. M. Rehorovsky's tables differ from those of Mr. Durfee only in arrangement. The tables as arranged by the former are identical in form with those given by Prof. Cayley for the first ten orders in the *Phil. trans.*, vol. 147; while those of Mr. Durfee are arranged symmetrically, and cannot be included in a half-square, as M. Rehorovsky's are. — (*Sitzungsb. akad. wissensch. Wien*, 1882.) T. C. [691

Maximum value of a determinant. — The elements of a determinant being restricted to lie between $(-a)$ and $(+a)$, Mr. Davis finds, that, for all determinants whose order is greater than 2, a numerical maximum is found by making all the elements of the principal diagonal $=-a$, and all the remaining elements of the determinant $=+a$. In the maximum cubic determinant $D_n^{(3)}\,a^n$, all of the strata are made identical, and equal to $D_n^{(2)}$. The value of this determinant is $\pm\, n!\ D_n^{(2)}\,a^n$. Formulae are also given for hyperspace determinants. — (*Johns Hopk. univ. circ.*, No. 20.) T. C. [692

Functions of several variables. — M. Combescure seeks to develop completely the immediate conditions to be satisfied by an analytic function of several imaginary variables. Assuming $z_1, z_2 \ldots z_n$ as the variables, these are defined by the equations $z_j = x_j + iy_j$, where $j = 1, 2 \ldots n$. Then the function to be considered is $F(z_1, z_2 \ldots z_n) = \phi + i\psi$. The differential co-efficients of ϕ and ψ of the first order are connected by relations precisely similar to those connecting these quantities when there is only one variable, z: so, when one of the functions ϕ or ψ is given, the other may be found by simple quadratures. It is shown that the group of conditions for the determination of ϕ reduces itself to the $\frac{n(n+1)}{2}$ partial differential equations of the second order, $\Delta_{h,k}\phi = 0$, where

$$\Delta_{h,k} = \frac{d^2}{dx_h\,dx_k} + \frac{d^2}{dy_h\,dy_k},$$

for $h, k = 1, 2 \ldots n$, and, of course, including the cases where $h = k$. These are the necessary and sufficient conditions to be satisfied by ϕ. A means is given of representing ϕ analytically by an exponential series, the co-efficients of which depend upon the sines and cosines of $(\alpha_1 x_1 + \ldots + \alpha_n x_n)$ and $(\beta_1 y_1 + \ldots + \beta_n y_n)$; $\alpha\,\beta$, as well as the constant co-efficients of these sines and cosines, being indeterminate real quantities, to which we can give any values we please. — (*Comptes rendus*, Jan. 22.) T. C. [693

Homologies and conics. — If L and M are two fixed points on a conic, K, and P a variable point, then P H, perpendicular to L M, cuts again the circle L M P in a point, H, which describes a conic, K′. If the circle on L M as diameter cuts K again in E F, then L M and E F are the axes, and the point at infinity in the direction P H is the common centre of two of the twelve homologies which two conics in general determine. The ratio of corresponding areas of K and K′ is constant, — a function of the eccentricity of K and of the inclination of L M to the focal axis of K. Given, on the other hand, the centre and axes of the homology, two triply infinite systems of conics, K and K′, can be determined; the conics of each system being similar and similarly placed, and the common points at infinity of one system being orthogonal to those of the other. All the conics of the plane are thus distributed into a doubly infinite number of triply infinite systems. The net of conics determined by three arbitrary points in a plane will give a doubly infinite number of conics, one out of each system, and hence will produce all the homologies of the plane, and each once only. There is therefore a (2,1) correspondence between the doubly pointed plane and the plane of the homologies. The discussion of these points by Luigi Certo is followed by an investigation of the variation of the ratio of corresponding areas, first, with the variation of the eccentricity, and, second, with the variation of the direction of the line L M. He also considers the distribution in the plane of the pairs of similar conics of which the system of conics through four points on a circle is composed. — (*Giorn. mat.*, xx.) C. L. F. [694

PHYSICS.

Optics.

Color of water. — W. Spring reviews the several explanations suggested to account for blue and greenish colors of water in lakes and seas, — Bunsen's idea of inherent color, Tyndall's theory of reflection, and others, — and concludes that some further study of the question is needed. Blue from reflection would imply red by transmission, but this is not observed from diving-bells. The author concludes provisionally that the color depends on the presence of certain salts, especially calcic carbonate in solution. The more complete the solution, the bluer the water. — (*Rev. scient.*, 1883, 161.) W. M. D. [695

(*Photometry.*)

Spectrum photometry. — MM. J. M. de Lépinay and W. Nicati have recently completed an investigation of the relative brilliancy of white surfaces when illuminated by different colored lights and by different portions of the same spectrum. In the preliminary experiments, two lights were employed, — a yellow and a blue one, — the blue light being the fainter. Their intensity was compared by means of a Rumford photometer, casting very small shadows.

Two experiments were tried. In the first, the yellow light remained stationary, and the blue one was moved towards the screen till equality of the shadows was obtained. In the second experiment, the blue light was left in its first position, and the yellow one moved away from the screen till the shadows were equal. On comparing the results obtained, it was found that they differed materially from one another. In another experiment the two shadows were cast so that when the eye was in a certain position they appeared of equal brilliancy. On approaching the screen, the blue shadow was found to appear more brightly lighted than the other; and, on going away from the screen, the reverse effect was observed. To further investigate these results, two methods of measurement were employed: 1. The intensity of the light corresponding to the different wave-lengths of the spectrum was determined by means of a Rumford photometer, as above described; 2. A small figure consisting of three short, broad, black lines, drawn on a white surface, was placed in different portions of the spectrum, and the intensity of the light increased or diminished until its outlines were just distinguishable.

It was found that the results obtained by the two methods agreed almost exactly for the less refrangible portion of the spectrum, as far as wave-length 517; but beyond that point the differences suddenly became very marked; and it was shown that a blue light had to be many times brighter than a yellow one in order to distinguish the same details by its aid; also, that the brighter the lights were, the more marked did this difference become.

Now, for purposes of artificial lighting, whether public or private, the end desired is less to produce a luminous sensation upon the eyes than to enable us to distinguish the objects around us. It is therefore concluded, that, for lights of equal brilliancy, the superiority of yellow sources (such as gas-flames and incandescent electric lamps) to sources richer in the blue rays, as the arc light, is beyond question. — (*Journ. phys.*, Feb.) W. H. P. [696

Electricity.

Transmission of power. — Experiments relating to the electrical transmission of power were made on the 4th of March last, in Paris, at the *Chemin de fer du Nord*, before a commission of the French institute, composed of MM. Bertrand, Cornu, Tresca, de Lesseps, and de Freycinet. The resistance of the line was 160 ohms, — a resistance equivalent to that offered by a copper wire 106 kilometres in length, and 4 mm. in cross-section. The power applied to the generating-machine was equivalent to 4.4 horse-power; and the rotation of the generating armature was varied from 380 to 1,024 revolutions per minute in order to ascertain the effect of speed of rotation upon the mechanical return at the other end of the line. As the general result of the experiments, '*La Lumière électrique*' announces that the available power transmitted was 47.5% of that which actuated the generating-machine. — (*La Lum. électr.*, March 17.) A. G. B. [697

ENGINEERING.

Steel for structures. — Mr. Ewing Matheson discusses at considerable length the important question of the modern use of steel for engineering-works. The author commences by stating the following propositions: 1. Rolled plates and bars of the various forms required for structures are now made of steel with as much certainty, in regard to quality, as iron of the first class; 2. Advantages in regard to size and weight of pieces can be obtained in steel, which in iron are either impossible, or can only be had at very great expense; 3. Steel has a superiority in strength, ranging from once and a half to twice that of iron, and at the same time a more than proportionate superiority in ductility and elasticity; 4. Steel can be bent, straightened, cut, punched, planed, and drilled with the same tools and processes that are used for iron, and, for the most part, without extra force; 5. Protection against rust is of more importance for steel than for iron, but, if treated in the same way as is usual with iron, steel is less liable to waste by rust; 6. Owing to the above advantages, structures of steel are superior to those of iron, but economically it is only in some cases in regard to ships, and in still fewer cases in regard to bridges, that there is at present any pecuniary advantage in using steel; 7. This limit to the application of steel is due partly to official rules, which restrict the working-strains on steel, and partly to exigencies of design, which hinder the reduction in size and weight of members to the extent which its superior strength might otherwise allow; 8. Although, for the above reasons, steel structures may cost more than iron without any immediate compensation, yet, if measured by actual units of strength and durability, steel is cheaper as well as better for all but very small structures; 9. The employment of steel may be encouraged and extended by a fuller knowledge, among those who use it, of its qualities, by facilities for verifying these qualities by exercising a wider choice of the kind of steel suited to the purpose in view, and by such a liberal alteration of the present official rules as will allow fuller advantage to be taken of steel than is usual or permitted at present. The simplicity of manufacture, as compared with that of rolled iron, renders almost certain a nearer approximation in cost, if, by a wider permission, the demand for steel should increase. Each of the above points is taken up in detail and carefully considered, the admiralty specifications for steel plates for ships are given, the question of steel riveting is examined, the important matter of rust is discussed, and an extended comparison is made between the weight and cost of iron and steel for bridges. The whole paper is of great value, and well worth careful study. — (*Proc. inst. civ. eng.*) G. L. V. [698

Recent hydraulic experiments. — At a meeting of the Institution of civil engineers held in London Nov. 14, 1882, Major Allan Cunningham gave an account of an extensive course of experiments on the flow of water in the Ganges canal, extending over four years (1874-1879), the principal object being to find a good mode of discharge measurement for large canals, and to test existing formulae. Not less than fifty thousand measurements for velocity were made, and six hundred for surface slope, while five hundred and eighty-one cubic discharges were measured under very varied conditions. Forty measurements of evaporation from the canal surface were made in a floating pan, during twenty-five months. The results showed the movement of water in such a canal to be in many respects quite different from those before reported. — (*Engineering*, Nov. 17, 1882.) G. L. V. [699

Railroad accidents, and the earth's rotation. — R. Randolph shows that the deflective force arising from the earth's rotation is entirely too small to determine derailments, and also, that, as an excess of right-handed derailments has been credited solely to north and south tracks, this proves it to be wholly imaginary; for the deflective force at any latitude is the same for all directions (*Van Nostrand's engin. mag.*, 1883, 117). The numerical results given are but half

their true value, as two elements of the deflective force are omitted (SCIENCE, p. 98); but this does not affect the author's conclusions, as the deflective force is still insignificant, and, for a fast train in this latitude, amounts to but about $\frac{1}{3000}$ of the weight. — W. M. D. [700

The type of modern marine engines. — Constructing-engineer Albrecht, of the Austrian navy, discusses the various forms of engines and boilers which have been proposed or used, gives data and indicator-diagrams for various ships, shows that the compound engine effects a saving of fifty-seven per cent over the simple, and pronounces the three-cylinder compound engine the most economical and best. — (*Mitth. gebiete seew.*, x. 9.) C. E. M. [701

Torpedo-nets. — Lieut. Sleeman, R.N., proposes to render torpedo-nettings useless as a protection for ships by sending one Lay torpedo after another, in the same path, at short intervals. The first breaches the net; the second passes the breach, and explodes against the ship. — (*Journ. de la flotte*, Feb. 18.) C. E. M. [702

Pendulum-chronograph. — Capt. Caspersen, of the Danish army, has devised a chronograph for ballistic purposes, which consists of a pendulum prolonged above its point of suspension so that it can be arrested at its extremities at will by levers connected with electro-magnets. A horizontal wire is fastened at the point of suspension, with its ends bent so as to dip in cups of mercury; and thus, when the pendulum is oscillating, the contact is made alternately on the two sides, and registered automatically on a dial. The instrument measures with precision the hundredth of a second. — (*Mitth. gebiete seew.*, x. 9.) C. E. M. [703

CHEMISTRY.

(General, physical, and inorganic.)

Conduct of moist phosphorus and air towards carbonic oxide. — In repeating the experiments of Leeds and of Baumann, Prof. Ira Remsen and E. H. Kaiser observed a copious precipitate on passing the mixed gases through barium hydrate. When, however, all contact of the gases with corks and connectors was prevented, there was no formation of barium carbonate. — (*Amer. chem. journ.*, iv. 454.) C. F. M. [704

White phosphorus. — A modification of phosphorus, quite different in its properties from the variety hitherto known as white phosphorus, was obtained by Remsen and Kaiser in the distillation of ordinary stick phosphorus. The distillation was conducted in an atmosphere of hydrogen, and the distillate collected in a receiver partly filled with water and ice. At the end of the distillation a thin white cake was found floating on the surface of the water. It dissolved readily in carbonic disulphide, melted at the same temperature as the common form, and, on melting, was transformed into the latter. It withstood the action of sunlight longer than ordinary phosphorus. — (*Amer. chem. journ.*, iv. 459.) C. F. M. [705

Specific heat and valence of thorium. — On further study of the metal thorium, L. F. Nillson finds that it is tetratomic, and that its atomic heat calculated from the mean of several determinations of the specific heat 0.02787 is 6.4. Analogous to silicon, it forms a fusible alloy with platinum; and the composition of its chlorplatinate corresponds to those of tin and zirconium. — (*Berichte deutsch. chem. gesellsch.*, xvi. 153.) C. F. M. [706

Formation of arsenides by pressure. — When a mixture of zinc filings and arsenic in powder was subjected to a pressure of 6,500 atmospheres, W. Spring observed the formation of an arsenide (Zn_3As_2). Corresponding arsenides of lead (Pb_3As_2), cadmium (Cd_3As_2), and of copper (Cu_3As_2), were also prepared. Varying the proportions of copper, Cu_6As_2 and $Cu_{12}As_2$ were formed. Tin gave Sn_3As_4, and silver Ag_3As and Ag_6As, the latter a brittle mass of metallic lustre and gray color. — (*Berichte deutsch. chem. gesellsch.*, xvi. 324.) C. F. M. [707

Production of apatites and wagnerites containing calcium bromide. — When sodium bromide is heated to a temperature just above fusion, and calcium phosphate is added to it, A. Ditte states that well-developed hexagonal pyramids separate on cooling, which have the composition $CaBr_2 . 3(Ca_3(PO_4)_2)$. On heating calcium bromide and calcium phosphate together, a compound ($CaBr_2 . Ca_3(PO_4)_2$) corresponding to wagnerite crystallizes in long needles. If calcium arseniate is used, instead of the phosphate, in the preceding experiments, in the first case the compound $CaBr_2 . 3(Ca_3(AsO_4)_2)$ crystallizes in hexagonal pyramids, and, in the second case, $CaBr_2 . Ca_3(AsO_4)_2$ is formed. When vanadic acid is fused with sodium bromide and calcium bromide, the chief product is a bromo-vanadate, $CaBr_2 . 3(Ca_3(VO_4)_2)$. The corresponding wagnerite ($CaBr_2 . Ca(VO_4)_2$) results when the acid is fused with pure calcium bromide. Analogous compounds may be formed in which calcium is replaced by other metallic elements. — (*Comptes rendus*, xcvi. 575.) C. F. M. [708

The atomic weight of lanthanum. — Since the atomic weight of lanthanum was reduced by the results of Brauner to 138.28 from 139.15, the value formerly obtained by Cleve, the latter sought to verify or disprove Brauner's result by a more careful preparation of the material from which the atomic weight was determined. From 1.5 kilos. of the mixed oxides of cerium, thorium, lanthanum, and didymium, the first two elements were removed by treating the partially decomposed nitrates with water, and didymium by fractional precipitation with ammonium hydrate. The seventh fraction was converted into the sulphate, and submitted to fractional crystallization. The last mother-liquor contained 10 grms. of the sulphate, which, on analysis, gave 138.69 as the atomic weight. Since a trace of didymium could still be detected by the spectroscope, the fractional crystallization was continued until analysis showed a constant percentage of lanthanum. The mean of several determinations gave 138.22 as the atomic weight. Cleve seeks to explain the difference between his results and those of Brauner by the different methods employed to obtain pure material. He thinks, that, since Brauner depended upon a fractional crystallization of the oxalates, his product may have contained a trace of yttrium. — (*Bull. soc. chim.*, xxxix. 151.) C. F. M. [709

METALLURGY.

Silver-milling at Charleston, Arizona. — According to Mr. W. Lawrence Austin, the ore, as the mine was developed, gradually changed, and was found to carry wulfenite (molybdate of lead). The bullion resulting from milling this changed ore ran down to from 200 to 300 fine. The fineness was again restored to 970 by stamping much finer, and giving up altogether the grinding in the pans; departing from the usual custom of stamping, 35 mesh to the inch, and grinding, and also by the use of lime in cleaning the amalgam. Cerussite and galenite did not cause the same trouble as wulfenite. — (*Eng. min. journ.*, Jan. 27.) R. H. R. [710

Refractory bricks. — The waste liquors from manufacturing potash salts at Stassfurt and Leopoldshall, containing 27 to 30% of chloride of magnesium, are now saved. The evaporated salt is treated, at an elevated temperature, with highly superheated steam in an oxidizing flame; and nearly chemically pure magnesia and hydrochloric acid of 21° Baumé, are obtained. This magnesia is well adapted, not only for making the cement of oxychloride of magnesia, but also for making magnesia fire-bricks, now so much used. — (*Eng. min. journ.*, Feb. 24.) R. H. R. [711

Proposed modification in copper-smelting. — Paul Johnsson proposes to heat the 35 to 40% copper matte, derived from cupola or other furnace smelting, in a Siemens furnace, and to direct a blast of air upon the surface of the molten metal, in order to oxidize the impurities, and to bring the matte forward to blister copper in one operation of 12 hours. He estimates that 20 tons of matte could be treated in one furnace, with the labor of 10 men, in 24 hours; while, by the old method, 8 calciners, 4 reverberatory furnaces, and 40 men, would be required to do the same work. — (*Eng. min. journ.*, March 3.) R. H. R. [712

Bessemerizing matte in a reverberatory furnace. — H. M. Howe refers to the article of Paul Johnsson (*Eng. min. journ.*, March 3), and claims that the credit of the process belongs to the Orford nickel and copper company, and not to Paul Johnsson. —(*Eng. min. journ.*, March 17.) R. H. R. [713

GEOLOGY.

Lithology.

Lithology of the Eisengebirge. — The rocks of the Eisengebirge of Bohemia are divided by Helmhacker into three groups, — crystalline schistose rocks, crystalline massive rocks, and clastic (fragmental) rocks. Under the first are described rocks classed as amphibole gneiss, gneissoid granulite, porphyroid, mica schist, and phyllite; under the second group are placed red granite, gray granite, gneissoid granite, syenite, granite porphyry, quartz porphyry, felsite porphyry, diorite, diorite aphanite, diabase, gabbro, uratite diorite, corsite, and troktolite; and of the last, a diorite-tuff-conglomerate only is described.

Under the name 'porphyroid,' a term well known in the early part of this century and previously, Helmhacker places rocks which resemble quartz and felsite porphyry, but have a schistose structure. They possess a felsitic groundmass and crystals arranged in more or less parallel layers. Phyllite is divided into staurolite, andalusite, and ottrelite phyllite, and fruchtschiefer and lydite. In the thin section, the first is seen to possess a groundmass composed of sericite plates, between which biotite scales and magnetite grains were lying. The staurolite lies porphyretically enclosed in this groundmass, and shows aggregate polarization. In the second, the groundmass is principally composed of biotite scales and magnetite or anthracite grains. The andalusite in the thicker sections is of a pale rose tint; in the thinner, colorless. The ottrelite schist or phyllite was formed by the contact metamorphosis of black argillite with granite. This formation of ottrelite schist, by the action of intrusive rocks, agrees with the present writer's observations on Lake Superior (*Bull. mus. comp. zoöl.*, vii. 45). The ottrelite or chlorotoid plates are surrounded by a very fine, granular, scaly groundmass, formed principally of a muscovite-like mineral, which polarizes brilliantly. The irregular polygonal ottrelite plates have a pale grayish-green color, and are plainly dichroic. They are homogeneous, and, excepting some dust-like grains of magnetite, are free from inclusions.

The term 'troktolite' is the equivalent of the more common one 'forellenstein'; and the diabase-tuff-conglomerate belongs to that class of rocks which the present writer named in a briefer way, in 1879, porodite (*l. c.*, v. 280). Our space forbids an adequate idea of an extended paper filled with details. — (*Arch. natur. landesdurchf. Böhmen*, 1882, v. 87.) M. E. W. [714

METEOROLOGY.

Winds on sea and on land. — Mr. Alexander Buchan has recently discussed the observations of the wind made by the Challenger during its cruise of three years and a half, ending with May, 1876. Observations of the force and direction of the wind were made on 1,202 days, at least 12 times each day. Of these, 650 were on the open sea, and 552 near land. The seas were the North and South Atlantic, North and South Pacific, and the Southern Ocean.

Mr. Buchan finds the diurnal range of the wind-velocity on the open sea very small, not varying more than 1 mile, on either side of 17.5 miles per hour, during the 24; while near land the range was very marked, being nearly 15 miles per hour at 2 P.M., and only a little over 11 from 9 P.M. to 8 A.M. This he explains from the fact that the daily range of surface-temperature, for example, on the North Atlantic, is only .7°; and hence over the ocean the atmosphere rests on a floor the temperature of which is all but constant day and night. On approaching the land, however, the daily range of the temperature of the air over the sea becomes materially augmented, and amounts to 4.3°; and we know, from all observations, that on the land the range is still greater. This shows that the phenomena of the daily range of wind-velocity is intimately associated with that of the surface-temperature. Mr. Buchan writes, "So far as concerns any direct influence on the air itself, considered apart from the floor or surface on which it rests, solar and terrestrial radiation do not exercise any influence in causing the diurnal increase of the wind-velocity with the increase of temperature." On nearing land, the wind is everywhere greatly reduced in force, the retardation being due chiefly to friction. The winds were found lightest over the North Pacific (14.5 miles per hour), and strongest over the Southern Ocean (23.5 miles per hour). — (*Nature*, March 1.) H. A. H. [715

Rainfall of New South Wales. — A valuable map by H. C. Russell, for 1881, shows a fall of forty to sixty inches at several points along the coast north and south of Sydney, and diminishing to twenty or even ten inches on the plains of the Darling River, some five hundred miles inland. — (*Journ. roy. soc. N. S. Wales*, xv.) W. M. D. [716

Weather-predictions in Australia. — All the Australian colonies being now connected by telegraph, it is proposed to issue daily, at Melbourne, a weather-chart, showing atmospheric conditions at nine A.M., and attempting predictions for the following day, especially when cyclone disturbances show themselves within the vicinity of the coast. Most of these storms come from the southern Indian Ocean, and move east or north-east, sometimes running ashore, sometimes passing south of Tasmania. As the barometer falls on their approach, warm north winds come down with increasing strength from the heated interior country. Rain is generally heaviest with these winds, but sometimes falls to a considerable amount after the storm-centre has passed, the wind veering through the north-west, as a rule, but some-

times backing through the east when the centre passes inland. Australia sends storm-warnings by cable to New Zealand. Nearly every barometric depression observed in the former region reaches the latter, requiring two or three days for the intermediate ocean-passage. — (*Trans. roy. soc. Victoria*, xviii.) W. M. D. [717

PHYSICAL GEOGRAPHY.

Hawaiian Islands. — Preparatory to his studies of the Cascade range, Capt. Dutton, of the U. S. geological survey, visited the Hawaiian Islands last year. He regards Kilauea formed independently of Mauna Loa, and describes its lava-lake. The colossal eruptions of Mauna Loa were especially remarkable: that of 1855 would have built Vesuvius. The mountain has no cinder-cones; and when in eruption there is no roar of vapors or cloud of steam, but a huge river of fiery lava wells forth like water from a radial fissure on the mountain flank, sometimes beginning as a great fountain several hundred feet high, then swiftly flowing down toward the sea. The lava being very liquid, the volcano is abnormally flat, and, as yet, it has no streams or ravines upon it; but there are many long tunnels in the lava, which lead the drainage underground. Mauna Kea has numerous cinder-cones, which form striking features on its slopes. The difference between the erosion on its windward and leeward sides is very marked. The other islands were also examined. Haleakala, on Maui, presents grand scenery in its deep valleys; Oahu and Kaui are also deeply eroded, implying a cessation of their activity earlier than that of Hawaii, but not necessarily an earlier beginning. — (*Amer. journ. sc.* 1883, 219.) W. M. D. [718

GEOGRAPHY.

(*Arctic.*)

Norwegian arctic fishery in 1882. — The fisheries from Tromsö and Hammerfest employed 575 persons, in 67 vessels of 2,654 tons total burden, and produced, in 1882, 148 walrus, 5,839 seal of all species, 117 beluga, 49 polar-bears, 211 reindeer, 332 kilos eider-down, 65 hectolitres whale-blubber, 261,400 haddock, 369 hectolitres of haddock-livers, and 2,430 of other fish-livers, — having a total value of some 210,-000 kronor, or about $60,000. — (*Deutsch. geogr. bl.*, vi. i. 1883.) W. H. D. [719

Commerce of the White Sea. — In curious contrast with prevalent notions about the arctic regions, are the statistics of trade between the four ports of Norwegian Finmark and the Russian ports of the White Sea, especially Archangel. In 1881 four hundred and seventy vessels, employing over two thousand men, visited the Finmark ports; and in 1882 a still larger number, bringing goods, chiefly the product of the rich fisheries of the White Sea, to the amount of more than $700,000, and receiving cargoes for Russia of nearly equal value. — (*Deutsch. geogr. bl.*, vi. i., 1883.) W. H. D. [720

(*Asia.*)

Persia. — Stack's 'Six months in Persia' (2 v., New York, *Putnam*, 1882) is an entertaining narrative of an overland journey by one well fitted for it from his knowledge of the language of the country. His descriptions seldom have an especially geographical turn, as most of his route had been fully described before; but one would like to hear more of the burial of the old town of Askizar in drifting sands (ii. 4), of the depth to which the rivers have cut in the alluvial slope at the foot of the mountains, so as to be out of reach for irrigation, and of the ascent of Demavend (ii. 179). The characteristic Persian landscape is desert plains bordered by rugged mountains, with villages along the lower slopes where they can get a supply of water. The accounts of the people's dissatisfaction under Persian misgovernment; of their apparent desire for external control, and their wonder whether it will come from Russia or England, of which they have very indistinct notions; and of the polyglot society in the larger towns, — are all of interest. A chapter is given on the outfit necessary for travelling in comfort; and a number of route-maps illustrate the several parts of the journey from Bushir to Karmán, Ispahan, Tehran, and the Caspian. — W. M. D. [721

Southern Persia. — Persian exploration seems to be attracting much attention in England; and the March number of the Royal geographical society's proceedings is almost entirely occupied with the accounts of recent travellers there, and the discussions their narratives excited. Col. Champain points out the small amount of trade carried on with Persia by British merchants, and shows that Russian wares are superseding British in the Persian markets. This he ascribes to the wretched condition of the roads from the southern coast of the country and in Turkish Arabia, and advocates an attempt to improve them, as well as to build a railroad from Baghdad to Khanakin (100 m.), and to improve the channel of the Karún River where obstructed by rocks at Ahwaz. G. S. Mackenzie, of the house of Gray, Paul, & Co., at Bushir, on the Persian Gulf, described his experience on inland journeys, made some years ago, as far as Ispahan; and, while he considered it too soon to project railroads there, he thought much could be done by improving the rivers and roads. Capt. H. L. Wells gives detailed narrative and surveys of several routes across the mountainous country from Bushir, inland to Ispahan, and from Lake Niris, near Shiraz on the south-east, as far as the Karún River, 300 miles to the north-west. Although far better than the deserts of central Persia, the towns are generally forlorn and dirty, and the roads are very rough. Lake Niris is also quite unlike the flat swamps of the desert regions farther east, as its shore-line is very irregular, its banks are often precipitous, and numerous rocky islands rise from its blue waters. It was found to have a large extension to the east from its north-western end, not previously explored, known as Tasht or Nargis, joining the main lake by a narrow passage. The lake has no outlet, and its waters are bad but drinkable. Ruins and cuneiform inscriptions were found at several points. — W. M. D. [722

Yesso. — This northern Japanese island is described by Dr. Brauns of Halle as even more picturesque than Dai Nippon. Its surface is sharply broken by mountain and valley, and the volcanic peaks and leaping streams give it a most attractive landscape. Volcano Bay, north of Hakodate, with numerous cones rising to six thousand feet around it, is named as one of the most beautiful places in the world. The central part of the island contains a bold and high range of old crystalline rocks, bordered by the heavy miocene lignite formation, and the fossiliferous pliocene strata. The volcanic rocks belong with the latter, and consist of the true eruptive masses (Lyman's 'old volcanic formation') and the later stratified tuffs, which often cover extensive areas. No glacial action is recognized in the quaternary deposits. Brief notes are added on the fauna and flora. — (*Verh. erdk. Berl.*, 1883, 43.) W. M. D. [723

BOTANY.

Cryptogams.

Action of light on Algae. — Berthold has made a minute study of the action of light on seaweeds, especially Florideae, and gives the results of his observations on species growing near Naples, and of his cultures made at the zoölogical station in that city. Under the influence of feeble illumination, the species studied turned towards the light; but, when stronger light was used, they turned from it. He considers, in detail, the effect of light in modifying the growth and branching of different species. Many seaweeds are, at some seasons of the year, covered with colorless hairs, whose function has hitherto been supposed to be connected with absorption of nutritive material. Berthold denies this supposed office of the hairs, and maintains that they act as a protection against too bright light, and states that exposure to light is followed by an increase in the growth of hairs. He also gives an explanation of the iridescence of certain species, which is produced by the formation of small plates on the outer part of the cells, as in Chylocladia, or by globular or irregular bodies in the cells, as in Chondria and Cystoseira. He denies the existence of any true fluorescence in such cases, which he considers to be merely instances of iridescence, and asserts that the plates and globules act as shields against too strong light. He also attributes a similar function to the calcareous incrustation found in Chara and seaweeds like Acetabularia and Corallina. — (*Pringsheim's jahrb.*) W. G. F. [724

Fertilization of red seaweeds. — Professor Fr. Schmitz has published some general observations on red seaweeds, in which he advances the view that the thallus in this group of Algae is always of a filamentous origin, no matter what the cellular character of the mature frond may be, and secondary cell-divisions never include the axis of the primary cells. He considers, in detail, the fertilization and the formation of the carpospores, and is of the opinion that there is no indirect impulse transferred from one cell to another at a distance, even in genera like Dudresnaya and Polyides, but that there is always a direct transfer of cell-contents. The abstract question of the nature of the sexuality in Florideae, as compared with that of other orders, as Ascomycetes and Collemaceae, is treated at length; and he unites the Bangiaceae with Chlorophyceae, rather than with Florideae, as has recently been done by Berthold. — (*Bericht. akad. wiss. Berlin.*) W. G. F. [725

Phenogams.

Influence of sunny and shaded localities on the development of foliage-leaves. — Stahl of Jena has given considerable attention for several years to the effect which light has in the development of the assimilative tissues. It has been held by some that the degree of exposure of a leaf unfolding from the bud can have no influence upon the character of its cells, except so far as etiolation or blanching might produce it. Upon reviewing all the evidence in the light of his recent researches, Stahl thinks that in shaded places the leaves have a less well-marked palisade system, whereas in full sunlight they develop a better palisade system and a less well-characterized spongy parenchyma. The author is convinced that these facts in regard to the partial adaptation of leaves to their surroundings should be borne in mind in the selection of the amount of light in our greenhouses. The paper is well illustrated. — (*Zeitschr. naturwissensch.*, xvi.; N. S., ix. 1, 2.) G. L. G. [726

The largest flower. — Dr. Thurber gives an account of the pollination of Rafflesia, written in an interesting way for young readers. The immense mottled flowers, with an expanse of three feet and a weight of fifteen pounds each, are dioecious. They are fertilized by flesh-flies, attracted by their carrion odor. — (*Amer. agric.*, April.) W. T. [727

ZOÖLOGY.

Coelenterates.

Structure and development of nematophores. — As the result of his study of the nematophores of Aglaophenia, Antennularia, and Plumularia, Merejkowsky concludes that we must abandon the old view that a nematophore is an amoeboid mass of sarcode, since the use of reagents shows that it is made up of distinct nucleated cells. These cells are derived from both layers of the body; the endoderm forming the central axis, and the ectoderm the outer layer. The nematophore is usually divided into two parts, of which one shows no power of motion, and contains a battery of very large lasso-cells; while the second portion is very movable, and exhibits amoeboid changes of form. The active portion is composed entirely of ectoderm, while the immovable portion contains an endodermal axis. The active portion presents a peculiar type of histological structure, since its cells are embedded in and surrounded by a structureless layer of contractile protoplasm, which has in itself the power of active change, and to the contractile power of which the amoeboid movements are due. This protoplasmic layer seems to correspond to that which unites together the cells of labyrinthula; and something similar is found in sponges.

Merejkowsky's investigations of the development of nematophores have led him to believe that these structures are neither organs which have been acquired for a special purpose, nor specialized polymorphic hydranths, but simply degenerated hydranths.

In support of this view, he says, that, when a colony of Plumularia halicioides was kept over night without a supply of running water, the tentacles and oral orifice disappeared, the whole body became reduced in size, and the hydranth thus became converted into something which bore a very close resemblance to a nematophore. The ectoderm gave rise to long pseudopodia, and changed its form continually, exhibiting amoeboid movements which were almost exactly like those of a true nematophore. — (*Arch. zool. exp. gén.*, 1882, 4.) W. K. B. [728

Worms.

Haplobranchus, a new serpulid. — A. G. Bourne describes Haplobranchus aestuarinus, a new species of serpulid, belonging, apparently, to the Sabellidae, but differing from all known forms. A description, including a few anatomical notes, is given. The worm was found on both the Irish and English coasts. — (*Quart. journ. micr. sc.*, 1883, 168.) C. S. M. [729

The species of branchiobdella on cray-fish. — Oustroumoff has found a species near Kasan on the gills of Astacus leptodactylus, but which is nearer to B. parasita than to B. astaci, and for which he proposes the name B. astaci leptodactyli. — (*Zool. anz.*, vi. 76.) C. S. M. [730

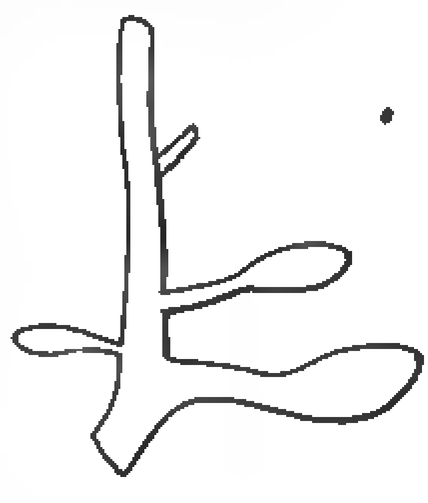
The teeth and synonymy of Dochmius. — Megnin discusses the synonymy of the genera Dochmius, Strongylus, and Ankylostoma. Dujardin separated Dochmius as toothless forms: but Megnin finds teeth in the Dochmius of the dog; and, believing that they will be found in the other members of the genus, he maintains that the name ought to be re-

placed by Ankylostoma, which has priority for toothed forms of Strongylids. The teeth have been previously overlooked. — (*Bull. soc. zool. France*, 1882, 282.) C. S. M. [73

Insects.

Caddis-fly cases. — Miss C. H. Clarke figures and describes two interesting new forms of larval cases of Hydropsychidae from Massachusetts. One of them, that of a Hydropsyche, resembles a tunnel, loosely attached to a stone by its lower edges, the stone forming the bottom. It may be composed entirely of sand or of vegetable fragments, or of both, and is peculiar for having at its mouth a vertical framework, with a net stretched across it, as in the figure, to catch its prey. The case is built in swiftly running water, and the supporting framework of the net is occasionally stayed by silken cords stretching to suitable points on the stone.

The other, that of a Plectrocnemia, is a tall cylindrical chimney, with lateral tubes expanding into chambers. The chambers usually end with a small aperture, but sometimes extend into another short piece of cylindrical tube with an aperture at its end. The upper end of the main tube has occasionally two openings, though commonly one. These tubes are found erect in the muddy bottoms of brooks, and, but for the apical opening, look like the twigs one may see stranded in



such places. Miss Clarke was unable to discover in which part of the case the larva lived; but the pupa was always found in the upright shaft, its place usually indicated by an enlargement. — (*Proc. Bost. soc. nat. hist.*, xxii. 67.) [732

VERTEBRATES.

Origin of the vertebrate mesoderm. — Romiti discusses His's view, that the mesoderm has a double origin, in part from the primitive streak, and in part from independent cells, which His calls parablastic, and thinks derived from the yolk, and destined to form the connective and vascular tissues. Romiti admits the double origin, but maintains that the independent cells are derived from the germinal portion. The cells in the periphery of the mesoderm are derived "from the proliferation of some large cells which have emigrated from the segmented germ, and lie between the primitive layers." — (*Arch. ital. biol.*, ii. 277.) C. S. M. [733

Formation of serum albumen in gastric digestion. — It is generally believed that proteids, when digested in the stomach or small intestine, are transformed into peptones, and absorbed in that form; but there has always been the objection to this view, that peptone cannot be found (or, if found, then only in minute quantity) in the blood of the portal vein, or in the chyle. Hence, if the proteids eaten were turned into peptone, and absorbed in that form, they must very quickly be converted into the albumens of the blood, lymph, or chyle. Von Ott now claims that he has proved that serum albumen is produced in the stomach and intestines during digestion. But his proof consists, 1°, in assuming that Martius was correct when he stated that no proteid but serum albumen will cause the heart of a frog, which has been brought to a standstill by washing with salt solution, to beat again; and, 2°, in showing, that, from the contents of the stomach or intestine of a digesting animal, a solution can be prepared which will make the heart recommence beating. As numerous intermediate and by-products are known to be formed during the digestion of albumens, and as Martius did not experiment with several of these, it is clearly necessary that the action of each on the heart be studied before we are justified in concluding that a heart which is fed by a liquid containing them is nourished by serum albumen, and not by them or some one of them. Von Ott finds that milk is an excellent food for the frog's heart, but that it loses this power when all proteids are removed from it. — (*Du Bois' archiv*, 1883, 1.) H. N. M. [734

Excitation of vascular nerve-centres by the summation of electrical stimuli. — Kronecker and Nicolaides have examined the influence of successive stimuli upon the vaso-motor system, in order to see if the vascular nerve-centres obey the laws which have been established in this regard for the reflex movements of the limbs. They find a general agreement. Single induction shocks applied to vaso-motor centres in the medulla or spinal cord have no influence upon arterial pressure. Moderately strong stimuli first begin to act by summation when they follow at not greater intervals than half a second. Increasing the rate of stimulation increases the effect up to a rate of from twenty to thirty per second: increase of rate beyond this has no effect. Keeping the rate quite slow and constant, but increasing the intensity of the stimuli, increases the effect, but never so much as quickening the rate. The maximum of blood-pressure can be obtained either with powerful shocks at $\frac{1}{10}-\frac{1}{12}''$ intervals, or moderately powerful induction shocks at $\frac{1}{20}-\frac{1}{25}''$ intervals. It takes longer to attain the maximum result with slow, powerful stimuli, than with weaker, but more rapid; also with slow stimulation the absolute number which must be given before the maximum result is attained is greater. The conclusion is therefore reached, that the cells of the vascular nerve-centres agree essentially with the proper motor cells of the spinal cord in having an inherent tendency (in the dog) to vibrate at a rate of about twenty times a second. — (*Du Bois' archiv*, 1883, 27.) H. N. M. [735

Tetanic stimulation of frogs' nerves by a constant current. — Von Frey has lately carried on a series of investigations as to why a frog's muscle is sometimes tetanised — though usually only giving a single twitch — when a constant galvanic current is sent through its nerve. He points out some of the conditions under which the long-continued contraction is observed, and shows that it is a true tetanus, and not merely a very prolonged twitch. — (*Du Bois' archiv*, 1883, 43.) H. N. M. [736

Fish.

Spawning-habits of Ceratodus. — Mr. Haswell has stated before the Linnaean society of New South Wales, that Mr. Morton, of the museum, had ascer-

tained that the so-called 'Ceratodus' of Queensland spawns during the months of June, July, and August, in the Burnett River. A slight excavation is made by the fish in the bed of the river, in water about eight to ten feet deep; and the male and female guard the nest till the eggs are hatched. Hope is held out that a supply of fertilized eggs may be procured next season, and the embryology of the type studied. Thus a great gap in our knowledge of the ancient fish-types may be filled up. — (*Nature*, March 15.) T. G. [737

Development of the pike's skull. — An important memoir on the development of the membrane-bones of the pike's skull has been published by Dr. Johannes Walther. The observations were chiefly made on the young, representing two stages of development, — one 11 and the other 22 mm. long. The author recognizes five categories of ossifications; viz., 'hautknochen,' including 'cementknochen,' 'bindegewebsknochen,' and 'perichondralknochen (centrifugal wachsend)'; and 'knorpelknochen,' including 'perichondral (centripedal wachsend)' and 'enchondral.' For his generalizations, we must refer to the memoir itself (*Jena. zeitschr.*, xvi. 59, pl. 3, 4). In this connection, we may also call attention to a monograph on the development of the pike's shoulder-girdle and pectoral-fin, published by Dr. G. Swirski at Dorpat in 1880. — T. G. [738

Isaak Walton, and the river Lea. — An interesting article on the little river Lea, as it is at present, has been published under the above caption by R. B. Croft. A list of the fishes, with notes as to their occurrence (whether abundant or rare), will enable the Waltonian to compare the past and present of the river immortalized by the 'father of angling.' It supplements a paper some time previously published by Mr. Littleboy in the transactions of the Watford natural history society (ii. 113). — (*Trans. Hertf. nat. hist. soc.*, ii. 9.) [739

Mammals.

American sirenians. — The discovery of a new fossil sirenian in South Carolina brings the number of known existing and extinct forms in North America to eight (Cope. *Proc. acad. nat. sc. Philad.*, 1883, 52). The Florida manatee is still extant in that state, and it is probable that the South American manatee may yet be found in Texas. Two extinct forms (Anoplonassa forcipata, from Georgia; and Hemicaulodon effodiens, from New Jersey) have been previously described by Cope. The type of Owen's Prorastomus was from the West Indies. Two other extinct species of manatee, founded upon teeth, and the new generic form, Dioplotherium Manigaulti, all from South Carolina, complete the number. From recent remarks by Mr. W. H. Dall (*Biol. soc. Wash.; meeting* March 30), it would appear certain that Rhytina has not existed on the coast of the Alaskan peninsula since the advent of man, and probably never. It cannot, therefore, be added to the list of American sirenians. — F. W. T. [740

Foetus of a seal. — Camerano, in vol. xxxv. of the Memorie of the academy of Turin, describes the anatomy of a nearly mature foetus of Otaria jubata Forst. Its length, with the hind-limbs extended, was 51 cm.; its structure showed a close affinity with other carnivora. The author gives a description of the thoracic girdle with measurements. It is noteworthy that the scapula and the coracoid apophysis are relatively more developed than in the adult. The comparison of the cranium with that of the adult shows that variations occur here similar to those observed in the gorilla, especially in the proportion between the cranium proper and the facial region. The brain differs in the usual manner from that of the adult. The right ventricle of the heart is shorter than the left: in the adult they are about equal. The same difference with age exists in lions. The coronary vein is very large. From the aortic arch arise only two vessels, — the innominate trunk and the left subclavian, — not three, as in the adult: the young, therefore, resembles in this respect the aquatic carnivora, with which it is probably phylogenetically related. — (*Arch. ital. biol.*, ii. 285.) C. S. M. [741

(*Man.*)

Duration of fecundity in man. — The generally accepted notion that the period of fecundity for the male does not extend beyond the sixtieth year, and for the female the fortieth year, is shown by M. Mignot to be to a certain degree incorrect. He cites numerous cases which show that the period may extend to the seventieth year in the male, and to the fifty-sixth or fifty-eighth in the female. — (*Soc. sc. med. Gannet*, xxxvi. 19.) F. W. T. [742

The intermedius of the carpus in man and other mammals. — Leboucq has re-examined this bone by aid of microscopic sections, with a view of determining its relations to the other bones of the wrist. It first shows itself with distinctness in human embryos, of which the hand has a length of 2 mm., appearing as a cartilaginous nodule inserted between the scaphoid and the first three bones of the drital row. In hands 2.5 mm. long it appears as a polyhedral nodule attached to the scaphoid at one point near the palmar surface, but otherwise free. In hands 4.5 to 5 mm. long the cartilaginous attachment is broader, but the intermedius is still distinguishable. With the growth of the foetus, the boundaries become less and less distinct, and finally disappear. Leboucq, therefore, decides that the intermedius does not disappear by atrophy, but by fusion with the scaphoid. He does not agree with Rosenberg, that the space supposedly left vacant by atrophy of the intermedius is filled with *tissu à vacuoles*, with large nuclei (?) in its walls, but by simple ligamentary fasciculi.

Although having no new facts to contribute, regarding the chimpanzee and gorilla, in which the intermedius disappears in the adult, he believes that it combines with the scaphoid as in man. In the dog and the cat, the intermedius is also as in man, but extends less in the dorselumbar direction. In embryo bats (notably in Vespertilio murinus) the intermedius is distinctly visible. Its presence in marsupials needs further confirmation. In conclusion, Leboucq states his belief that the intermedius is present in the embryos of all pentadactyle mammals. — (*Bull. acad. sc. Belg.*, (3), iv. 220.) F. W. T. [743

ANTHROPOLOGY.

Resources of anthropology. — The student of any branch of human knowledge is always grateful to those who will show him the results of other men's labors. The surgeon-general's office in Washington has undertaken to be the guide of anthropologists in this respect. Under the direction of Dr. J. S. Billings and Dr. Robert Fletcher, aided by a force of accomplished assistants, are issued the Index medicus and the Index-catalogue of the surgeon-general's office. The former is a monthly catalogue of medical literature, classified so as to be most serviceable to the practitioner, as well as to the student of human biology. Through a system of exchanges and purchases, all the creditable medical anthropological journals of the world are promptly received, and their contents indicated through the Index medicus.

The anthropologist will always find useful information under the words bibliography, anatomy, physiology of the brain and nervous system, biology, abnormalities, anthropology, and craniology. The second-named publication appears in quarto volumes, in which every subject upon which any thing contained in the surgeon-general's library has been written is catalogued with conscientious minuteness, and with reference to the ready convenience of the student. Three volumes have already appeared. — O. T. M. [744

(Old world.)

Anthropology of Caffraria. — The anthropological documents collected in Caffraria by M. Delegorgue in the years 1838–44 are made the text of a paper by M. Hamy. He begins with a *résumé* of the writings upon Caffraria prior to the travels of M. Delegorgue, commencing with the 25th of December, 1497, when Vasco da Gama named the country of Natal from the Nativity. To those making a study of the tribes so prominent for their bravery in the face of British soldiers, this chapter will be eminently useful. The documents for which we are indebted to M. Delegorgue relate especially to the Amazulus, although other members of the Bantu group and the Bushmen are not overlooked. In the third chapter of his monograph M. Hamy brings together what is known concerning the craniology of the Caffir tribes, with a table of measurements. — (*Nouv. arch. mus. hist. nat. Paris*, 1881.) J. W. P. [745

Corea. — Mr. William Elliot Griffis is the author of a work upon 'Corea, the hermit nation,' just published by Charles Scribner's Sons. The author made good use of his opportunities, while connected with the imperial university of Tokio, to collect all that could be ascertained concerning the exclusive peninsula. Mr. Griffis makes it very clear that Japan received its first impulses to art and civilization through Corea. Around this favored spot have contended a thousand influences for the mastery, — Mongolians, Cossacks, Japanese; Buddhism, Confucianism, ancestral worship, and Christianity; exclusivism and liberalism. From these bloody conflicts the people have suffered untold miseries, and have been kept back in the progressive march of civilization. A great deal of the space in the volume is devoted to the sociology of the Coreans, a subject in which anthropologists will be especially interested. The unsuccessful endeavors to effect commercial treaties with the Coreans are narrated at length, as well as those which met with a more favorable reception in 1882. — J. W. P. [746

Craniology of the Mongoloids. — Dr. Frederik Carel ten Kate, jun., made the craniology of the Mongoloids the subject of an inaugural dissertation at Heidelberg, and L. Schumacher of Berlin has published his researches in a pamphlet of fifty-eight pages. Several pages are devoted to a minute bibliography of the subject, which makes the paper all the more valuable. Fifty-three crania are minutely measured and described, as follows: Chinese, 10; mixed Chinese, 7; Japanese, 5; Berings people, 4; Yukagir, 1; Tunguses, 5; Bureats, 5; Calmuks, 5; Tatars, 4; Yakut, 1; Baschkirs, 2; Lapps, 4. — J. W. P. [747

(New world.)

Peruvian stone-quarrying. — A short paper by Boussingault contains some information with regard to the ancient working of stone in Peru, which is of general interest. An old quarry exists in the environs of Quito. In the trachyte and among the refuse was found a chisel which had evidently been used in quarrying. Its surface was scratched and worn, its edge indented, and its head bruised by the blows of the hammer. Its specific gravity was 8.83, or a little more than that of melted copper. A chemical analysis made by Damour showed that it was composed of 95 % of copper, 4½ % of tin, .2 % of lead, .3 % of iron, and traces of silver.

This bronze was not sensibly harder than common copper; and Boussingault suggests that it was owing to the rock possessing less hardness through its 'quarry water,' that it could be worked by such instruments. By the same cause he endeavors to explain the preparation of the granite monuments observed in Peru by La Condamine, adding thereto the skill and dexterity which the Indian race possessed in the use of their bronze tools. Boussingault's conclusions will probably be questioned by many until the strongest proof is given of their correctness.

He calls attention to the fact, that a chisel found in a silver-mine near Cuzco, and carried to Europe by Humboldt, gave, by Vauquelin's analysis, 94 % of copper and 6 % of tin. — (*Comptes rendus*, xcvi. 545.) M. E. W. [748

Chili. — The *Times* printing-house of Philadelphia has published a pamphlet of forty-eight pages upon Chili. Some information is conveyed concerning the forty thousand Indians within her borders. From the alliance of the Spaniards with the Araucanians, known under thirty or forty tribal names, from the Changos of Atacama to the Cuicos of Osorno, have come two million inhabitants, known severally as *huasos* (horsemen) and *rotos* (ragpickers). There are about forty thousand indigenes remote from civilization. The Araucanians proper are divided into three tribes, — Pehuenches, in the pine-groves (pehuen) of the Andes; Llanistas, in the plains (llanos); and the Costinos, in the cordilleras of the coast. A brief history of the founding of Chili is given, commencing with the famous quarrel between Don Diego de Almagro and Don Francisco Pizarro. — J. W. P. [749

Errors in Waldeck's drawings. — Professor Cyrus Thomas, who has studied the Palenqué tablet of the cross with considerable care, expresses the opinion, that the drawing of the inscription on the left slab as given in the plates of Waldeck's 'Palenqué et autres ruines,' edited by Brasseur de Bourbourg, is almost wholly copied from Catherwood's drawing as published in Stephens's Central America.

He bases this opinion upon the demonstrable fact, that a number of errors which can be pointed out in Catherwood's drawing are all faithfully copied in the Waldeck plate.

This applies only to the six columns of the left inscription, and not to the rest of the plate, which he thinks is more correctly rendered by Waldeck, except as to the human figures, than is Catherwood's drawing.

Is this opinion correct? If so, is the original of Waldeck's drawing yet in existence? These are questions we should be glad to have the French archeologist answer. Prof. Thomas is now preparing a paper for the Bureau of ethnology in which he will give more fully his reasons for this opinion. — J. W. P. [750

Indian music. — In every collection of American antiquities will be found gourd rattles, strings of shells, bones, hoofs, and seed-pods, drums, whistles of clay, wood, and bone, and frequently a stringed instrument, or a pan-pipe. These, "for the most part, are capable of nothing but inexplicable dumb shows and noise." Mr. E. A. Barber, however, has given the subject some attention, and has discovered instruments capable of a rude scale, from which the

fourth and the seventh are excluded, to which the name *pentatonic* has been given. The ancient Peruvians had music very difficult to learn, which expressed, with great compass and pathos, the agreeable and disagreeable emotions of their daily lives. Mr. Barber repeats an account, given by Don Fred. Blume, of the wails of a Peruvian woman on hearing the news of the death of a brother. "The announcement came, it seems, unexpectedly, and the explosion was that of a volcano of grief, — terrible jets from time to time; then a quiet interval; and then, again, a great outburst; and so on. . . . Thus I came to understand how their 'operas' originated, and how natural a mode of expression they are." — (*Amer. nat.*, March.) J. W. P. [751

Aztec music. — While arranging the Poinsett and Keating collections of antiquities in the museum of the academy, Mr. H. S. Cresson noticed some Aztec flageolets and whistles, or pitch-pipes of terra-cotta, an investigation of which had yielded some facts which might be of importance to the ethnologist. Most authorities upon the subject have arrived at the conclusion that the musical knowledge of barbarian tribes is confined to the limits of the so-called pentatonic scale, in which the fourth and seventh tones of the scale, as known to us, are wanting. Upon trying the four-holed Aztec flageolets in question, he had found, that, by closing the bell with the little finger, they could be lowered a full tone, and, from the tonic note thus obtained, the octave could be produced, including the fourth and seventh notes as known to us. Five of the flageolets in question were exhibited, — two in the key of C natural, one in the key of B natural, and the other two in F sharp and B flat respectively. The last-named instrument was chosen to produce the fourth and seventh tones, upon which an expert performer on the Boehm flute ran the diatonic and chromatic scales with but little difficulty. The pitch-pipes, or whistles, were next exhibited; and the same performer demonstrated that a full octave could be produced thereon, together with the ninth, eleventh, and twelfth notes, the tenth being missing. The whistle producing this tenth note must have existed, as it is preposterous to suppose that a people capable of manufacturing the instruments in our possession (several of which are duplicated in the collection), which may be played in trio or quartette, were not more thoroughly acquainted with the principles of music than to content themselves with the narrow limits of the pentatonic scale. This is proven by their ability to manufacture instruments capable of producing, not only the fourth and seventh tones of the diatonic scale, but also the entire chromatic scale. — (*Acad. nat. sc. Philad.; meeting* April 8.) [752

EARLY INSTITUTIONS.

New-England towns. — The student of early institutions in America will be interested in the recent 'History of Great Barrington' (Berks County, Mass.), by Charles J. Taylor. The upper township was distributed in forty proprietary rights. James Bowdoin had seven and a half; other persons had six, five, four, two and a half, or one apiece. These rights were fixed by the settling committee at four hundred acres each. Allotments were made accordingly. We are struck by the resemblance between these proprietary rights with equivalents, and the *mansi, cum campis, pratis, pascuis silvis*, in the German colonies of the early and middle ages. The free colonies, like most of our New-England towns, were associations of proprietors, with defined rights in the land; in recognition of which, each man received certain home-lots and arable lots, together with meadow, pasture, and forest lands; the latter being, very often, held in common. Mr. Taylor confines himself strictly to the history of his own town; but this history embraces many interesting facts, and is suggestive in many ways. The words of Burke, 'People will not look forward to posterity who never look backward to their ancestors,' are printed upon the titlepage. — D. W. R. [753

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody museum of American archaeology, Cambridge, Mass.

Altar-mounds in Anderson township, Ohio. — Several of the mounds explored the past summer by Dr. Metz and the curator contained 'altars,' or basins, of burnt clay, on two of which there were literally thousands of objects of interest. Two of these altars, each about four feet square, were cut out, and brought to the museum. Among the objects from the altars are numerous ornaments and carvings unlike any thing heretofore found.

One altar contained about two bushels of ornaments made of stone, copper, mica, shells, the canine teeth of bears and other animals, and thousands of pearls. Nearly all of these objects are perforated in various ways for suspension. Several of the copper ornaments are covered with native silver, which had been hammered out into thin sheets, and folded over the copper. Among these are several of the spool-shaped objects (which I now regard as ear-ornaments), a bracelet, and a bead. One small copper pendant seems to have been covered with a thin sheet of gold. This is the first time that native gold has been found in the mounds, and the small amount found here shows that its use was exceptional. The ornaments cut out of mica are very interesting, and embrace many forms. Among them are a grotesque human profile, and the heads of animals, whose features are emphasized by a red color. Many of the copper ornaments are large and of peculiar shape. There are about thirty of the singular spool-shaped earrings made of copper. Three large sheets of mica were also found; and several finely chipped points of obsidian, chalcedony, and chert, were in the mass of materials. Several pendants, cut from a micaceous schist, are of a unique style of work. Three masses of native copper were found on the altar.

But by far the most important things found on this altar were the several masses of meteoric iron and the ornaments made from this metal. One of these is half of a spool-shaped object, or ear-ornament, like those made of copper, with which it was associated. Another of these ear-ornaments is covered with a thin plating of the iron, in the same manner as others were covered with silver. There is also a folded and corrugated band of iron of the same shape, and nearly the same size, as the band of copper found in a mound in Tennessee, and figured in the last report of the museum (fig. 16). Three of the masses of iron have been more or less hammered into bars, as if for the purpose of making some ornament or implement, and

another is apparently in the natural shape in which it was found.

It is worth recapitulating here, that *native* gold, silver, copper, and iron, were all found on the altar of the large mound in this group, and that all were manufactured into ornaments simply by hammering.

On the altar of another mound of the group were several terra-cotta figurines of a character heretofore unknown from the mounds. Unfortunately, these objects, as well as others found on the altars, had been more or less burnt; and many of them appear to have been purposely broken before they were placed on the altars. Many pieces of these images have been united; and enough has already been made out to show their importance in the study of early American art. The peculiar head-dresses, method of wearing the hair, and the large button-like ear-ornaments, shown on these human figures, are of particular interest. The shape of the ear-ornaments leaves no doubt of the character of the spool-shaped objects previously referred to. On the same altar were two remarkable dishes in the form of animals, carved from stone, which have been nearly restored from a large number of small fragments. With these were a serpent cut out of mica, several hundred small quartz pebbles from the river, and nearly three hundred astragali of deer and elk. As but two of these bones could be obtained from a single animal, and as there were but one or two fragments of other bones, there must have been some special and important reason for collecting so large a number of these particular bones. A finely made bracelet of copper, and several other ornaments of copper, a few pearls and shells and other ornaments, were on this altar, with two large masses of native copper, and a mass of unworked meteoric iron. Many fossil shells were found on both altars.

Harvard college observatory, Cambridge, Mass.

Astronomical photographs. — It is proposed to form, at the observatory, a collection of photographs of the heavenly bodies and of their spectra. Original negatives would be particularly valuable. It may happen that some such negatives, having slight imperfections which would limit their value for purposes of engraving, could be spared for a collection, and would be as important, considered as astronomical observations, as others photographically more perfect. In some cases, astronomers may be willing to deposit negatives taken for a special purpose, and no longer required for study, in a collection where they would retain a permanent value as parts of an historical series. Where photography is regularly employed in a continuous series of observations, it is obvious that specimen negatives only can be spared for a collection; but in such cases it is hoped that some duplicates may be available, and that occasional negatives may hereafter be taken for the purpose of being added to the collection, to exhibit recent improvements or striking phenomena. When negatives cannot be furnished, glass positives, taken, if possible, by direct printing, would be very useful. If these, also, are not procurable, photographic prints or engravings would be desirable.

The observatory already possesses many of the early and historically important specimens which would naturally form part of such a series. Among these may be mentioned four series of daguerrotypes and photographs of various celestial objects, taken at this observatory. These series were respectively undertaken in 1850, 1857, 1869, and 1882.

Copies of memoirs or communications relating to the specimens sent, or to the general subject of astronomical photography, would form an interesting supplement to the collection. A part of the contemplated scheme will involve the preparation of a complete bibliography of the subject, including a list of unpublished photographs not hitherto mentioned in works to which reference may be made.

The expense which may be incurred by contributors to the collection in the preparation and transmission of specimens will be gladly repaid by the observatory, when desired.

NOTES AND NEWS.

— The titles of the papers read during the recent session of the National academy of sciences at Washington, April 17 to 20, were: Joseph LeConte, On the genesis of metalliferous veins (read by T. Sterry Hunt); Elias Loomis, On barometric gradients (read by Cleveland Abbe); Ira Remsen, On the nascent state of oxygen; E. D. Cope, On the structure of the skull in the Hadrosauridae; G. W. Hill, Determination of the inequalities of the moon's motion which are produced by the figure of the earth (a supplement to Delauny's 'Theorie du mouvement de la lune'); T. Sterry Hunt, The decay of rocks geologically considered; S. Weir Mitchell and E. T. Reichert, On the composition of the venom of serpents; Ira Remsen, On changes in the properties of atoms and atomic groups caused by changes in the position in a molecule: W. Ferrel, Maxima and minima tide-predicting machine; S. P. Langley, On the measurement of wave-lengths of heat; Otto von Struve, On the great object-glass made by Alvan Clark and Sons for the Pulkova observatory; S. P. Langley, On the spectrum of an argand gas-burner; G. F. Barker, Efficiency of storage-batteries; C. H. F. Peters, Photographs of the great comet of 1882; H. A. Rowland, Progress in spectrum photography; A. W. Wright, Some experiments upon a method of forming a visible image of the solar corona; A. W. Wright, On the phosphorescence of sulphate of quinine; Wolcott Gibbs, Further generalizations regarding complex inorganic acids; A. Agassiz, The fauna of the Gulf of Mexico.

The autumn session of the academy, for the reading of scientific papers, will be held at New Haven in November.

— Special reports Nos. 56 and 57 of the U. S. department of agriculture for February and March, 1883, are entirely occupied with statistics. No. 56 opens with a report upon the numbers and values of farm-animals in the several states and territories, including a comparison with the corresponding statistics of last year. These show that there has been a decided increase in the number, and in the average price per head, of these animals. The statistics of the cotton-crop point to a probable total movement of not less than 7,000,000 bales, of unusually good quality; making the total crop nearly four per cent larger than the great crop of 1880. The report contains, also, a comparison of the prices of English and American agricultural implements, an article on

transportation-rates in Europe, and a list of transportation-rates on the more important rail and water routes from the west to the seaboard. All these are obviously of more or less general interest; but it is difficult to see how it can be considered the duty of the department to publish, as it does in this report, a gratuitous advertisement of one particular western railroad, avowedly furnished by its western passenger-agent. Report No. 57 is on the distribution of the corn and wheat crops of 1882, and the comparative quantity still remaining on the farm. Statistics are also presented regarding the extent and character of the domestic uses of these crops, and tables of transportation-rates are appended to the report.

— The U. S. geological survey has commenced the publication of octavo bulletins to receive such papers, relating to the general purpose of its work, as would not properly come under the heads of annual reports or monographs. Each paper will be issued separately with a distinct number, and will have two paginations, — one proper to itself, at the top; and one belonging to the volume, at the bottom, — a most convenient arrangement. The first number, just issued, contains a paper by Whitman Cross on hypersthene-andesite, and on triclinic pyroxene in augitic rocks, with a geological sketch, by S. F. Emmons, of Buffalo Peaks, Col., where the principal rocks examined were found. Mr. Cross urges the need of a re-classification of the andesite rocks, and concludes that the chief subdivision of the augite-andesites may much more properly be called hypersthene-andesite Two plates accompany the bulletin.

— At its two hundred and thirty-third meeting, held April 7, the Philosophical society of Washington listened to Prof. W. C. Kerr, on the Geology of Cape Hatteras and the adjoining coasts; to Mr. H. F. Walling, on Topographical indications of a fault near Harper's Ferry; and to Mr. S. F. Emmons, on Ore deposition by replacement.

— At the annual meeting of the Cincinnati society of natural history, April 3, the following officers were elected: president, Dr. J. H. Hunt; vice-presidents, Professors John Mickleborough and George W. Harper; secretary, Davis L. James; treasurer, S. E. Wright; librarian, A. E. Heighway, jun. The report of the treasurer showed a balance in the treasury. The membership dues paid during the year amounted to a larger sum than in any previous year. Reports of the curators and custodian were handed in. The latter stated that the use of the museum by instructors of the high schools and academies was increasing yearly. The collections had been increased largely by donation and purchase, and were as well displayed as the limited space permitted.

— By the consent of the surgeon-general of the army, the Washington anthropological society held its last meeting in the army medical museum. Three papers were read, as follows: Myths of the Dhegiha, the stock including Omahas, Poncas, and Osages, by the Rev. J. Owen Dorsey; A year in anthropology, being a summary of works on man, which appeared in 1882, including those by Americans, those on America, and those of general anthropological interest, by Professor Otis T. Mason; A letter from Sir Rawson Rawson upon the relativity of stature to latitude, derived from the volumes of anthropometry published by the provost-marshal-general's bureau during the war of the rebellion, by Dr. Robert Fletcher.

— Prof. C. H. Hitchcock has just returned home from a tour to the Hawaiian Islands, having visited Kilauea, Mauna Loa, the source of the Hilo flow of 1881, and Haleakala. Kilauea has rarely been filled up with lava so much as at present, the 'black ledge' being covered by over fifty feet thickness of recently cooled lava.

— Mr. Frederick W. True has been appointed acting assistant director of the National museum, to serve during the absence of assistant director, Mr. Goode, who sailed, March 31, for London, to attend the Fisheries exhibition as U. S. commissioner.

— The Society of American taxidermists will hold their third exhibition in New York, May 1 to 5. The programme of the general meeting to be held May 1, at Lyric Hall, is: President Lucas, The scope and needs of taxidermy; William T. Hornaday, Common faults in the mounting of quadrupeds; Prof. F. W. Staebner, Taxidermic value of animal illustrations; President Lucas, On the mounting of crustaceans; F. S. Webster, Taxidermy as a decorative art; F. S. Webster, How to clean bird-skins of all kinds; Samuel F. Rathbun, How to make good bird-skins; Frederic A. Lucas, New method of skinning turtles; William T. Hornaday, Mounting mammal heads.

RECENT BOOKS AND PAMPHLETS.

Partsch, J. Die gletscher der vorzeit in den Karpathen und den mittelgebirgen Deutschlands nach fremden und eigenen beobachtungen dargestellt. Breslau, 1882. 209 p., 4 kart. 4°.

Plumandon, J. R. Le baromètre appliqué à la prévision du temps dans la France centrale. Paris, 1883. 15 pl. 12°.

Renault, B. Cours de botanique fossile, fait au Muséum d'histoire naturelle. Troisième année. Fougères. Paris, *Masson*, 1882. 36 pl. 8°.

Rütimeyer, L. Die Bretagne. Schilderungen aus natur und volk. Basel, 1883. 8°.

Saporta, le marquis de. Apropos des algues fossiles. Paris, *Masson*, 1882. 10 pl. 4°.

Scheffler, H. Die magischen figuren. Allgemeine lösung und erweiterung eines aus dem alterthume stammenden problems. Leipzig, 1882. 114 p., 2 pl. 8°.

Scheiner, Jul. Untersuchungen über den lichtwechsel Algols nach den Mannheimer beobachtungen v. Prof. Schönfeld in den jahren 1869 bis 1875. Inaugural-dissertation. Bonn, 1882. 31 p. 8°.

Schmid, A. E. v. Leitfaden für den unterricht in ausgewählten kapiteln der chemischen technologie. Zum gebrauch an handels-, industrie- und gewerbeschulen. Graz. 330 p. 8°.

Schmitz, F. Die chromatophoren der Algen. Vergleichende untersuchungen über bau und entwickelung der chlorophyllkörper und der analogen farbstoffkörper der Algen. Bonn, 1882. 184 p., 1 pl. 8°.

Schultz, G. Die chemie des steinkohlentheers mit besonderer berücksichtigung der künstlichen organischen farbstoffe. Braunschweig, 1882. 1106 p., illustr. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

Patrons of Science and Education.

In this country there are many wealthy and prosperous people who take pleasure in helping along young and promising educational institutions of various kinds. It is, for instance, but a short time since Mr. Slater gave a million dollars for education in the South. In the hope, therefore, of attracting the attention of broad-minded and well-to-do Americans who are willing to do some good work of the noblest class, but in a moderate way, the publisher of "Science" desires publicly to make known that there are several hundred public libraries, thriving educational institutions, and eminently respectable scientific organizations throughout the United States, which are anxious to keep regularly on file the consecutive issues of "Science," but are unable to do so, as they have no funds for periodicals, or but very few at best, and have very limited means for their other work.

The Science Company are making an effort to furnish a weekly scientific journal which shall reflect creditably on American progress, and shall be useful in higher education. It has therefore a claim on the people of this country to help it attain the very widest circulation, and particularly so among libraries and educational and scientific institutions.

To aid in this work, the publisher asks the patrons of science and education to subscribe for a number of copies of "Science," to be sent to these institutions in the names of the respective donors, with full credit on every issue of the paper. These institutions may be designated by the donor, and may be merely for one subscription, or more, as the donor feels inclined. If desired by the donor, the publisher will select them from earnest requests for the regular issues of the paper, already on file, from many worthy institutions and growing libraries.

Any such subscriptions will be acknowledged to the donor first by the publisher, and then by the beneficiary. They will also be duly credited in the Classified List of Subscribers to "Science," which is now in preparation, to be issued in book form.

The subscription for one year, including postage, is only five dollars. This will pay for 1,500 pages of text from the pens of many of the most competent writers in this country, and will surely prove an acceptable and commendable gift to any institution of the class designated.

THE SCIENCE COMPANY.

Officers and Directors.

D. C. GILMAN, President,
President of the Johns Hopkins University.

ALEX. GRAHAM BELL, Vice-President,
Inventor of the Bell Telephone, Washington.

GARDINER G. HUBBARD,
Of Washington.

OTHNIEL C. MARSH,
President of the National Academy of Sciences.

SAMUEL H. SCUDDER, Treasurer,
President Boston Society of Natural History.

See back page of this issue.

MOSES KING, Publisher, Cambridge, Mass.

FRIDAY, MAY 4, 1883.

THE PROPOSED MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE IN CANADA.

THE British association has not yet ventured to hold its meetings in any part of the empire beyond the limits of the British Islands. It has, however, so far crossed the sea as several times to hold meetings in Ireland; and its sister-association of France has set it an example by holding a meeting in Algeria. The idea of such extension of its geographical range is not altogether new. Projects of an international meeting have at various times been discussed, both in Britain and the United States; and it is understood that the present governor-general of Canada, who has shown much interest in the scientific progress of the new dominion, has had correspondence with leading men of science in England, with the view of either bringing the association to Canada, or securing a representative delegation to meet with the recently established Royal society of Canada.

The project of a visit to Canada only assumed definite form at the meeting last summer in Southampton. A motion was proposed, we believe by Capt. Bedford Pym, in the general committee, that the association should meet in Canada in 1883. This was lost on a division; but it was understood by the promoters of the scheme that the unfavorable result was in part due to the fact that they were unable to produce a definite invitation from any Canadian city. After the decision to meet in Southport in 1883, they therefore felt at liberty to propose that the meeting of 1884 should be held in the city of Montreal; and this was carried. Unfortunately, however, there was no official communication of this resolution till after the close of the meeting of the American association in Montreal: otherwise some steps might have been taken toward a combined gathering in 1884.

As soon as the resolution of the association was definitely known in Montreal, a movement was made to respond in a fitting manner. After a preliminary meeting called by the president of the board of trade, and at which there were representatives of the McGill university and of the Natural history society of Montreal, the mayor was requested to call a public meeting, which was large, influential, and enthusiastic, and which passed resolutions pledging the city to do all in its power to make the meeting successful; appointing, at the same time, a large committee of leading citizens to carry these resolutions into effect.

In so far as accommodations for the meeting is concerned, and funds for its expenses, there can be no doubt that Montreal can entertain the association as well as any of the British cities in which it ordinarily meets; and its geographical position and facilities for access, and for communication with all parts of Canada, the northern states, and the west, present many attractions; while there is reason to hope that a meeting of the British association in Montreal would be attended not only by all interested in science in Canada, but by large numbers of the scientific workers of the United States. The experience acquired last year in entertaining the American association will also afford very valuable guidance. It was felt, however, that the real difficulty lay in the transportation across the ocean of so large a body as the British association, or even of that scientific nucleus of it which constitutes its essential part. The matter was therefore brought under the notice of the dominion government with the view of securing aid toward the passage across the Atlantic; and it is understood that a grant will be made sufficiently large to insure free passages to the officers of the society, and some of its more important members, who will also be the guests of the city, and reduced rates in favor of all the members who may be able to attend. Letters and printed circulars, giving information as to these points, have been sent to Sir Alexander Galt, the high commissioner of the dominion in London, and to Professor Bonney, the secretary of the association. From one of these, signed by the chairman of the local committee, and by Dr. Hunt, as chairman of the committee of invitation, the following extracts are taken: —

"The city of Montreal, which has a population of about 150,000 souls, has twice entertained the American association for the advancement of science, — for the second time, in August, 1882, when an attendance of more than nine hundred members and associates was registered, — and the association, with its nine sections, found ample accommodation in the buildings of McGill university. . . . We have assurance that the government of the Dominion of Canada will make a liberal grant of money to defray the expenses of members of the British association in crossing the ocean, and that the various railroad and steamboat lines in Canada and in the United States will offer most liberal arrangements to our guests. The Grand Trunk railway will arrange for an excursion of members of the association to the Great Lakes and Chicago; while the Canadian Pacific railroad will give an excursion to the provinces of the north-west, as far as the Rocky Mountains. The city of Montreal, from its climate, its geographical position, and its ways of communication, offers many attractions alike to the traveller and the student. The large and important collections of the geological survey of Canada, gathered during the past forty years, are in the museum at Ottawa; and these, together with extensive collections contained in the museum of the Natural history society of Montreal, and in that of McGill university, furnish ample materials for the study of the natural history of Canada. . . .

"Members of the British association, in coming to Canada, may be assured of a most cordial welcome and generous hospitality, not only from the citizens of Montreal, where every facility will be furnished for their meeting, but from the people throughout the country. It is hoped by the invitation committee that these assurances, and the above statement of the advantages and facilities offered them, may secure a large attendance of the members of the British association at Montreal in 1884."

It is well known that considerable opposition has existed in England to the project of meeting in Montreal; and it is natural that many of the life-members and associates who cannot visit Canada should view it with disfavor: but it is believed that the leading members of the association are of a different opinion, and that the hearty action of the city of Montreal and the dominion government will do much to disarm such opposition as may manifest itself next summer at Southport, where the final decision must be made.

It is to be observed, that in the present year the meeting of the American association, at Minneapolis, is early (Aug. 17); while that of the British association, at Southport, which is, besides, in the immediate vicinity of Liverpool, is unusually late (Sept. 19). This will allow members of the American association to attend both meetings; and it is stated that the retiring president of the American association, and possibly others of its members, may avail themselves of this privilege. This may possibly permit arrangements to be made which might substantially unite the meetings of the two associations in 1884, and so prepare for an international meeting in the future. If the meeting of the American association for 1884 can be fixed for some north-eastern city, sufficiently near to Montreal, and can be timed so as to occur a week before or after that of the British association, there can be no doubt that a great number of the members of the latter body would take advantage of the opportunity to enjoy the companionship of their American *confrères;* while, on the other hand, many of these would gladly spend a few days at the meeting of the British association. In this way it would seem that a greater benefit to science might result than even from an international meeting. There would be time for the complete transaction of the business of both associations. Neither would suffer, either pecuniarily or in the value of its proceedings; and there would be the best possible opportunity for interchange of ideas between the scientific men of the United States, Great Britain, and Canada. Nor is it unlikely that some scientific workers from the continent of Europe and elsewhere may be attracted by a combination so unusual. It may thus be hoped that the proposed meeting of the British association in Canada may not only be one of the most successful that this mother of associations has held, but may inaugurate an epoch of renewed activity and progress in the widely-spread scientific work of the two great associations of the English-speaking race.

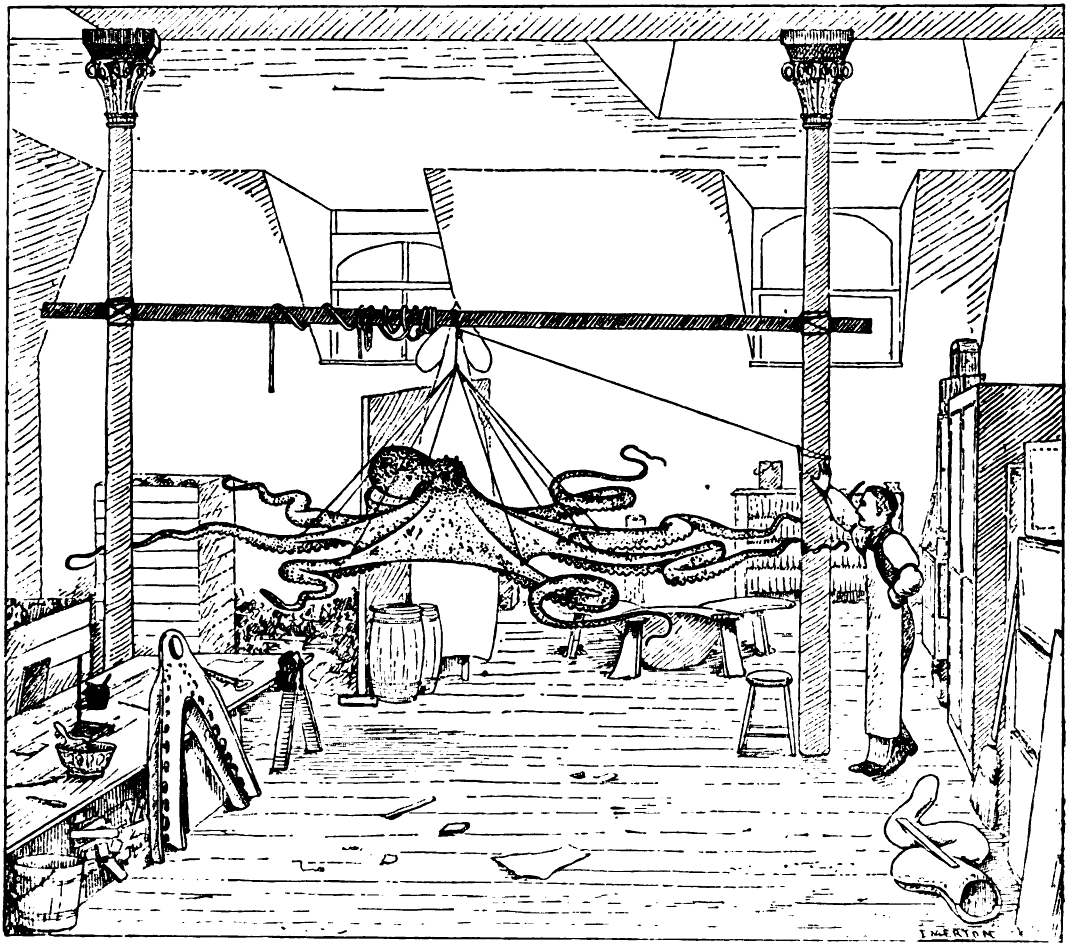
MODEL OF THE GIANT OCTOPUS OF THE WEST COAST OF AMERICA.

WHILE working on the models of the large Newfoundland squid (Architeuthis princeps) for the Yale and Harvard museums, it was proposed that I should also model the large Octopus of the west coast of America. Nothing was done upon it, however, until the past winter, while preparations were making by the U. S. fish-commission for the International fishery exhibition in London. For this exhibition, Mr. William Palmer, one of the modellers of the National museum in Washington,

was sent to New Haven to make a copy of the Architeuthis model; and, while this was in progress, plans for the Octopus were often discussed, and finally arrangements were made for him to remain in New Haven, to assist in making an Octopus model and a paper cast for the fishery exhibition.

As neither of us had seen the animal alive, nor could make a trip to California for the purpose, the model had to be copied chiefly from specimens preserved in alcohol, and restored according to the best information we could get as to its appearance when living. The largest specimens we could get were badly shrunken by the alcohol; and one of moderate size, with arms about three feet long, was selected; and from this most of the details of the model were enlarged four times.

The original description of Octopus punctatus by Gabb, in the proceedings of the California academy of sciences for 1862, is from a small specimen preserved in alcohol, and so was of little use; and there appears to have been no good description published since, though there have been numerous notices of the capture of specimens of large size.



MODEL OF THE GIANT OCTOPUS HANGING IN THE WORKSHOP OF THE YALE MUSEUM.

On all anatomical points we depended chiefly on Professor Verrill's knowledge of the cephalopods. In the color, size, and position of the body, we were aided by descriptions and sketches by Messrs. W. H. Dall and A. Agassiz, who had seen it alive. I was also guided by my knowledge of Octopus Bairdii, the small species of the east coast, which I had several times seen alive.

The position of the middle part of the body

is that often taken by Octopus Bairdii when resting on the bottom after swimming, with the head raised, and the body supported on the thickest part of the arms. The ends of the arms are curved irregularly, as they might be in an animal just starting to crawl.

The highest point of the body is twenty-two inches above the lowest suckers. The arms spread over a circle eighteen feet in diameter, and the connecting membrane between the lateral arms extends three feet from the mouth. The longest arms, those of the second pair, are made as long as the largest measurements from life (sixteen feet); and the shortest, the fourth pair, thirteen feet. The third arm on the right side is shorter than the others, and hectocotylized in the male, and is so made in the model. All the arms are four inches in diameter at the thickest part. The body is made proportionally smaller than in small specimens. The warts on the head are copied from one of the largest specimens examined, the others showing only two pairs over the eyes. The membranes between the arms have been made much as they are in alcohol, but somewhat wider and more distinct along the sides of the arms. The largest suckers are two and a quarter inches in diameter, and decrease in size from the thickest part of the arm toward the tip, and toward the mouth.

For convenience in making and moving the model, the arms are made removable at a distance of three feet from the mouth, just beyond the edge of the widest membrane.

The upper side of the middle part of the model, including the head and body, was modelled in clay, and a mould made from it in plaster. This was then turned over, and the mouth and under sides of the bases of the arms modelled in it. The arms are so much alike that it was only necessary to model the bases of two of them, — one right and one left; and from these a plaster mould was taken in which the casts of the bases of all the arms were made. This mould stands against the table at the left in the engraving. The ends of the arms were modelled in a similar way, the back being first finished, and a plaster mould made, which was turned over, and the under side modelled upon it. For modelling the tops of the suckers, a set of stamps was made. A set of suckers of the desired sizes was modelled in clay on a turntable, and plaster casts made of the tops of them, and these used to stamp the tops of the rest of the suckers, which were trimmed round with a knife, and attached to the arm with soft clay, after which, the narrow membranes connecting the larger suckers were modelled between them.

When the moulds were dry, the paper casts were made in them by methods which had been used by Mr. Palmer for models of large fishes and cetacea. The moulds having been greased, paper soaked with paste was laid in it, and pressed and rubbed with the hands until it fitted close to the surface of the mould, and the edges of the pieces of paper adhered together. When the first layer of paper was nearly dry, another was pasted over it; and, if the strength of the model required it, other layers were added. The thin membranes between the arms were strengthened by wire netting between the two layers of paper, the meshes being filled with whiting mixed with glue. On the surfaces of the suckers, paper pulp was put in the mould before the paper was pasted in.

After drying several days, the casts were taken from the moulds, the edges trimmed, and the pieces fastened together with glue. The broken places in the casts were mended with paper pulp, the joints covered over with the same material, and, when dry, the surface was smoothed with sandpaper, and varnished with shellac. The siphon was made separately, and afterward attached to the body. The mouth was made of plaster, showing the jaws closed. The eyes are of glass, like ordinary birds'-eyes, painted and silvered according to the best evidence we could get as to their color.

The color of Octopus punctatus seems to differ greatly, according to its moods and surroundings. It is commonly described as light orange or yellow with reddish-brown spots. At other times it appears to be bright orange and crimson, with dark-brown blotches on the back. The model was first painted light gray, on which the other colors were thrown from a brush in fine spots. The orange spots are scattered over the whole surface, and more thickly in patches along the back and sides of the arms. Crimson spots are distributed in the same way; and over both, dark-brown spots are thinly scattered. The faces of the suckers are yellowish white without spots.

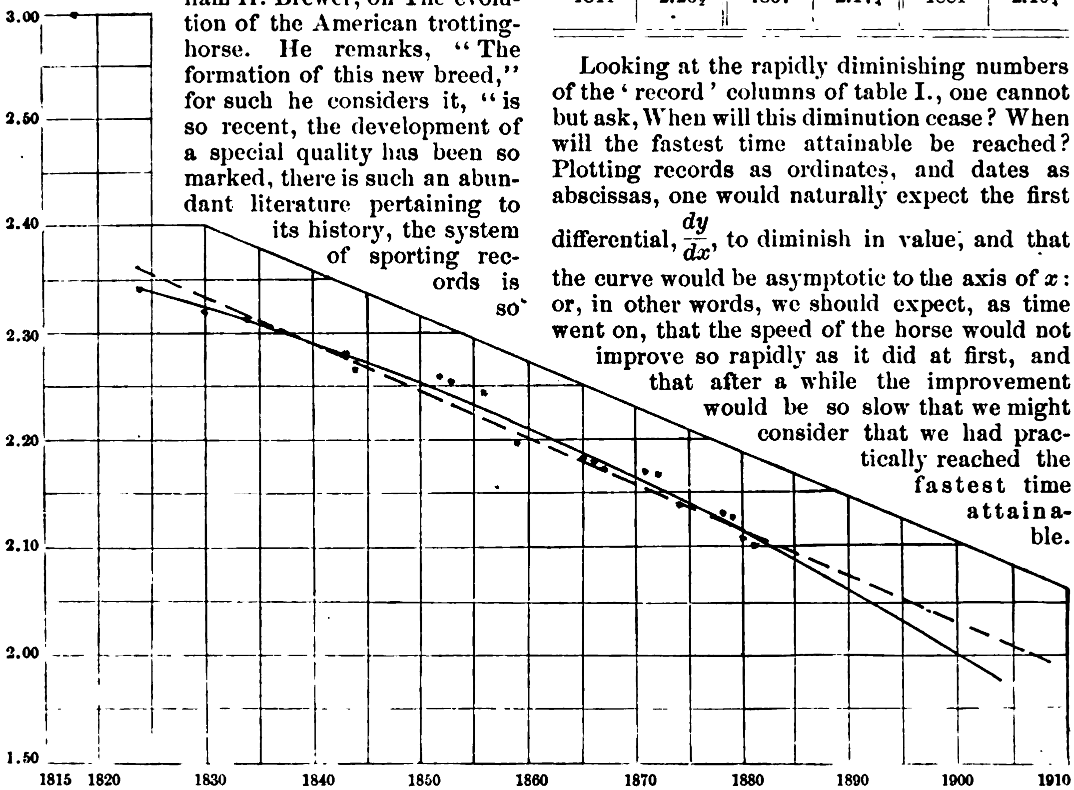
The model weighs about seventy pounds, and is stiff and strong enough for ordinary handling, and only liable to be broken by a fall or sudden blow. It is intended to be hung in a horizontal position, as in the engraving, but high enough for the under side to be seen, as well as the upper. It hangs by eight wires attached to rings near the joints in the arms, and connected together above so that it can be hung from a single hook.

The engraving shows the model hanging in

the workshop at the Yale museum. The pillars between which it hangs are fourteen feet high. On the floor, in the back part of the room, is the mould of the body, and bases of the arms. At the left, against the table, is the mould for the under sides of the bases of the arms, and at the right, on the floor, one of the arm-moulds, with the two parts fitted together.

J. H. EMERTON.

HORSE-TROTTING FROM A MATHEMATICAL STAND-POINT.



ABSCISSAS REPRESENT DATES; ORDINATES, THE BEST RECORD OF MILE HEATS.

In the April number of the *American journal of science* is a very interesting article by William H. Brewer, on The evolution of the American trotting-horse. He remarks, "The formation of this new breed," for such he considers it, "is so recent, the development of a special quality has been so marked, there is such an abundant literature pertaining to its history, the system of sporting records is so carefully planned and comprehensively conducted, and withal has become so extensive, that we have the data for a reasonably accurate determination of the influences at work which led to this new breed being made, the materials of which it is made, and the rate of progress of the special evolution." Towards the end of the paper are given some tables, which are copied in part beyond. The writer concludes by hoping that some one will plot the curves which naturally suggest themselves, and determine "how fast horses will ultimately trot, and when this maximum will be reached."

I.—Best record of mile heats up to the present time.

Date.	Record.	Date.	Record.	Date.	Record.
1818	3.00	1852	2.26	1871	2.17
1824	2.40	1853	2.25½	1872	2.16¾
"	2.34	1856	2.24½	1874	2.14
1830	2.32	1859	2.19¾	1878	2.13¼
1834	2.31½	1865	2.18¼	1879	2.12¾
1843	2.28	1866	2.18	1880	2.10¾
1844	2.26½	1867	2.17¼	1881	2.10¼

Looking at the rapidly diminishing numbers of the 'record' columns of table I., one cannot but ask, When will this diminution cease? When will the fastest time attainable be reached? Plotting records as ordinates, and dates as abscissas, one would naturally expect the first differential, $\frac{dy}{dx}$, to diminish in value, and that the curve would be asymptotic to the axis of x: or, in other words, we should expect, as time went on, that the speed of the horse would not improve so rapidly as it did at first, and that after a while the improvement would be so slow that we might consider that we had practically reached the fastest time attainable.

But we find, with the exception of the first, that all the points lie very nearly on a curve which is convex upwards: in other words, that the rate of improvement of the record is increasing instead of diminishing, and that it will cross the two-minute line about the year 1901.

It is very evident that this state of things cannot go on indefinitely: otherwise we should in course of time have a horse trot a mile in no

time at all. So that our curve must sooner or later become a straight line, and ultimately concave upwards. Drawing a straight line which shall agree as nearly as possible with our observations, we shall find from it, that the speed of the trotting-horse is increasing at a nearly uniform rate of 4½ seconds in ten years; so that, on this supposition, it would cross the two-minute line in 1907, and the one-minute line in 2045. It is highly probable that the curve will have become concave before the latter period; but it does not seem too rash to predict that a horse will be born before 1907 that can trot a mile in two minutes.

II. — Total number of horses capable of trotting in 2.30 or better.

Date.	No.	Date.	No.	Date.	No.
1843	1	1859	32	1871	233
1844	2	1860	40	1872	323
–	–	1861	48	1873	376
1849	7	1862	54	1874	506
–	–	1863	59	1875	–
1852	10	1864	66	1876	794
1853	14	1865	84	1877	836
1854	16	1866	101	1878	1,025
1855	19	1867	124	1879	1,142
1856	24	1868	146	1880	1,210
1857	26	1869	171	1881	1,532
1858	30	1870	194	1882	1,684

Table II. shows the enormous rate of increase of this new breed of animals, amounting to about twenty per cent a year. Treating the observations by the logarithmic method, we find, that, since 1864, the increase may, with a reasonable degree of accuracy, be represented by the formula $y = .0016\,x^4$, where y represents the number of horses, and x the number of years since 1850. Thus, for 1882, we have $y = .0016 \times 32^4 = 1678$. Applying this formula, we find, that, if the present rate of breeding is continued, the trotting-horses of America in 1900, that can travel a mile in 2.30 or better, will number not far from 10,000.

WM. H. PICKERING.

THE ORIGIN OF CROSS-VALLEYS.[1]

II.

RETURNING now to Virginia and Pennsylvania, we have to consider not only why the rivers there cross the mountains, but also why they flow to the south-east instead of to the north-west. Taking the last question first, we are forced to suppose that the north-westerly slope, which must have existed at least up to the end of the carboniferous, was then or soon after reversed in the slow writhing of the surface. This is demanded by the lay of the land, and by the now small area of what must have been, in paleozoic time, a large crystalline land-mass. The slope being changed early in the growth of the folds, or before their beginning, the streams tried to make their way to the eastward; and the Hudson, Delaware, Susquehanna, Potomac, and James are the descendants of those that succeeded. Their rectangular courses, alternately longitudinal and transverse, bear witness to their defeats and victories. Lakes must have been numerous here once, though they are now all drained. It is known that rivers often chose cross-faults of small throw as points of attack in cutting their way through the growing ridges; and it is very probable that they made use of pre-existent valleys when they advanced over the old sinking land.

In considering the applicability of backward-cutting lateral streams to the production of our cross-valleys, we should test the past by the present, and examine such ridges as Kittatinny or Bald Eagle mountains in Pennsylvania, or Clinch mountain in Tennessee, rising between parallel longitudinal valleys, to see if they show embryonic cross-valleys in the more advanced stages of development. They do not. The continuity of their crest-line is most characteristic and remarkable: it very rarely departs from its line of almost uniform height. The exceptions are, first, the finished water-gaps, or transverse valleys, whose origin is in discussion; second, the occasional wind-gaps, or notches, which sometimes cut the ridge a third or half way to its base, and which are, we believe, always determined by small transverse faults; third, the less conspicuous serrations of small value. It is difficult to assign any reason why lateral streams should not now, as well as in former times, show us the later stages of breaking down the ridge on which they rise; and yet these almost-formed cross-valleys between adjoining longitudinal valleys are practically unknown in our Appalachian topography. The reason of their absence can hardly be, that there are now enough completed water-gaps for all practical purposes, and hence the lateral streams stop making any more; for this would imply a consciousness of the end that plays no part in geological operations, and we are therefore constrained to think that Löwl's explanation cannot apply to the Appalachians in any general way.

But it has a certain limited application in

[1] Concluded from No. 12.

the making of 'coves,' as may be perceived by the following considerations. The backward-cutting of a lateral stream can form a water-gap only where the longitudinal valley into which the lateral stream flows is decidedly lower than the longitudinal valley on the other side of the dividing-ridge; for, if there is no such difference of level, the pass through the ridge between the two will be eroded more and more slowly as it is lowered, and finally it will remain at practically a constant altitude above the valleys on either side. It can never form a drainage channel joining them: but, if the longitudinal valleys are of different heights, the result as described by Löwl may be produced; or, if a broad plateau-fold is bordered by a deep valley, its lateral streams may finally head up in coves or circular valleys, like those south of the west branch of the Susquehanna, and at many other points in the Appalachians. The geological map of Pennsylvania (1858) shows these admirably.

Now it may be asked, Are not the upper valleys of the Susquehanna, and of the other rivers that break through the Blue mountain, merely large examples of 'coves'? There are two objections to this explanation. First, what became of the head waters of these rivers before they had a south-easterly outlet? It seems most probable, that the many pre-existent streams in each river-basin concentrated their waters in a single channel of overflow, and that this one channel survives, — a fine example of natural selection. Second, how does it happen — notably in the case of the Susquehanna just above Harrisburg — that several deep water-gaps have been formed one behind the other? Such an arrangement might naturally result if the valley were antecedent; but it is difficult to account for if the several gaps result from the backward erosion of accidental lateral streams.

Löwl thinks that faults are greater obstacles to rivers than folds. He says, that even if river erosion could, under certain favorable conditions, keep pace with mountain folding, it does not follow that it could control a fault: for that would imply that the fault was formed gradually, and that its throw increased at a constant though imperceptible rate; and this he considers entirely unwarranted (408). It is certainly a difficult matter to understand the mechanics of such faults; and yet our ideas concerning them must conform to the facts as they occur in nature. In spite, therefore, of a natural preference for an active growth of faults, we are compelled, when we see streams running across them from the downthrow to the upthrow side, to accord them a slow growth. Tennessee shows many examples of this paradoxical nature; and some of the faults thus disregarded, or, we might say, corrected, have a throw of several thousand feet. On the other hand, it cannot be denied that many faults have had a controlling influence on stream-courses; and we must therefore admit here, as above, the possibility of valley-cutting being stronger or weaker than orographic movements. The variety that is to be seen in the physical features of the earth, and that is consequently to be looked for in the conditions which determined them, is so great that it demands almost equal variety in the theories for their explanation. W. M. DAVIS.

Cambridge, Jan. 12, 1883.

THE ORIGIN, AFTER BIRTH, OF ASPIRATION OF THE THORAX.

THE negative pressure in the pleural cavities, which plays such an important part in the respiratory mechanism of the adult mammal, and also exerts a marked influence upon the flow of blood and lymph, is known not to exist in unborn or stillborn mammals which have never breathed. It has hitherto been assumed, however, that it was established with the first inspiration; and all theories as to its mode of production have been controlled by this belief. Hermann, in an interesting paper (*Pflüg. archiv*, xxx. 276), shows that this assumption is incorrect. In infants which have lived and breathed after birth for periods of from one hour to eight days, there is found on experiment to be no negative pressure in the pleural cavity when the chest-walls are in their death position. This fact leads, necessarily, to important results in regard to the respiration of young mammals. Their lungs in expiration can contain hardly any of what in the adult is known as 'residual' air: they contain still some air imprisoned in the air-cells, and causing them to float in water. But this 'minimal' air is practically no more than what remains in a piece of adult lung squeezed between thumb and finger. Except this minute quantity, there is in the new-born mammal no stationary air. At each inspiration, air direct from outside enters the alveoli of the lungs; and, at each expiration, air from the alveoli is expelled, leaving the lungs practically empty. Hence the renewal of the air in the lungs is much more efficient than in adults. The high percentage of oxygen which the alveolar air must contain is probably correlated with the more active oxidations known to occur in the young animal. The question naturally arises, What is the object of the residual air in the lungs, and the negative pressure in the thorax, which we find established later? Hermann suggests three possible objects: 1°. Aspiration on the veins, promoting bloodflow to the heart; 2°. More uniform composition of air in the alveoli [and, we may add, more uniform temperature]; 3°. The presence of a certain store of air in the lungs in the case of a temporary stoppage of the breathing-movements. It remains to be seen at what age and rate the negative pressure in the thorax is developed. It is obviously brought about by a more rapid growth of the thorax than of the lungs. H. NEWELL MARTIN.

PLANT-LIFE, PAST AND PRESENT.

THE opening lecture of the second course of 'Saturday lectures,' delivered at the National museum in Washington, was by Mr. Lester F. Ward, assistant geologist U. S. geological survey, and honorary curator of fossil plants to the museum; the subject being 'Plant-life of the globe, past and present.'

The object of the lecture was to give some account of the progress which has taken place toward the adoption of a truly natural system of botanical classification. After describing and comparing the methods of Linné, of A. L. de Jussieu, of Adrien de Jussieu, and of modern botanists, the lecturer pointed out the objections which may be made to all of these, and then presented the outline of a system which aimed to exclude the objectionable features, and to accord with the results of the latest discoveries in structural botany, and especially with the teachings of paleontology, which he claimed to have been too much ignored by botanists. The proposed system was as follows: —

- Cryptogams.
  - Cellular.
  - Vascular.
    - Filicineae
      - Filices.
      - Rhizocarpeae.
    - Lepidophytae
      - Equisetineae.
      - Lycopodineae.
      - Ligulatae.
- Phenogams.
  - Gymnosperms.
    - Cycadaceae.
    - Coniferae.
    - Gnetaceae.
  - Angiosperms.
    - Monocotyledons.
    - Dicotyledons.
      - Apetalae.
      - Polypetalae.
      - Gamopetalae.

The claims of this scheme as the nearest approach yet made to the system of nature were supported, for the most part, on paleontological grounds. To do this, an elaborate chart was presented, giving the geological history of each of the principal types of vegetation. This was in the form of a tabular exhibit of the number of species belonging to each type which have been found fossil at each geological horizon, and also the most reliable estimates that could be obtained of the number living at the present time in all parts of the world. It also showed the percentage that each type formed of the total known flora of each epoch. We give below a condensed view of this chart, which is all we have space to present.

Relative to this table, it should be explained, —

1. That the figures given for the living gymnosperms and dicotyledons are, in round numbers, those of Messrs. Bentham and Hooker, as stated for each genus and order in the 'Genera plantarum,' and which are here compiled, perhaps for the first time.

2. That the number of fossil species were collated from a great number of sources; Schimper's 'Traité de paléontologie végétale' being the basis, supplemented by data from all the more recent publications which were accessible, and by some unpublished data. Absolute completeness, however, was not claimed, but only such substantial accuracy as was deemed sufficient for the purposes of the lecture.

3. That under 'tertiary time' are included all the beds from the quaternary to the middle cretaceous; the latter being represented in this country by the Dakota group, and in Europe by the cenomanian. This is done because it is at the last-named horizon that the dicotyledons first appear, and because they appear here in such extraordinary profusion. Marquis Saporta has also made the vegetable tertiary to begin at this point.[1]

The facts embodied in this table were further graphically illustrated by two diagrams, prepared by Ensign E. E. Hayden, U.S.N. The first of these showed, by means of accurately plotted curves and colored areas, the development of each type of vegetation through the several ascending strata, the breadth of the areas at any epoch representing the prominence of the several types relatively to the entire flora of that epoch. The other diagram consisted of

Number of known species of fossil and living plants.

Geological periods.	Cryptogams.						Phenogams.							Total.
		Vascular.					Gymnosperms.			Angiosperms.				
											Dicotyledons.			
	Cellular.	Ferns.	Rhizocarpeae.	Equisetineae.	Lycopodineae.	Ligulatae.	Cycadaceae.	Coniferae.	Gnetaceae.	Monocotyledons.	Apetalae.	Polypetalae.	Gamopetalae.	
Present time	35,000	3,000	100	30	500	400	75	300	40	25,000	12,000	35,000	40,000	151,445
Per cent	23.10	2.00	0.05	0.01	0.32	0.25	0.04	0.20	0.02	16.50	8.00	23.10	26.41	
Tertiary time	302	202	7	27	2	5	19	253	3	446	1,285	1,650	499	4,700
Per cent	6.43	4.30	0.15	0.57	0.04	0.11	0.40	5.38	0.06	9.49	27.34	35.11	10.62	
Secondary time	112	298	1	33	1	-	198	90	-	19	-	-	-	752
Per cent	14.89	39.63	0.13	4.39	0.13	-	26.33	11.97	-	2.53	-	-	-	
Primary time: Carboniferous	19	664	3	81	298	-	67	54	-	-	-	-	-	1,186
Per cent	1.60	55.99	0.25	6.83	25.13	-	5.65	4.55	-	-	-	-	-	
Primary time: Devonian	29	35	-	4	16	-	5	5	-	-	-	-	-	94
Per cent	30.85	37.23	-	4.26	17.02	-	5.32	5.32	-	-	-	-	-	
Primary time: Silurian	19	1	-	2	2	-	1	-	-	-	-	-	-	25
Per cent	76.00	4.00	-	8.00	8.00	-	4.00	-	-	-	-	-	-	

[1] Le monde des plantes avant l'apparition de l'homme, p. 160.

a series of independent figures, designed to show the degree of development attained by each type at any epoch relatively to other epochs.

These charts and diagrams were thoroughly discussed; and the lecture closed with a few remarks on the genealogy of plants, illustrated by an arborescent figure showing one of the possible ways in which the present forms of plant-life may have been derived.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

Intelligence of the crow.

JAPAN is the birds' paradise, as fire-arms cannot be carried except by special permit. Though their punishment of criminals is sometimes extremely cruel, to shoot birds for sport or for scientific purposes would never enter the heads of this kind-hearted people. I noticed, in many parts of the country, that the crow felt a sense of security, meeting man boldly, conscious that he is a benefactor — and acknowledged as such — by killing injurious grubs, even though he collect a few grains of corn in the operation. He scorns to fly at your approach, and fears not a stick pointed at him, which he never takes for a gun. He is as familiar in Japan as he is shy in America and Europe.

Another instance of this bird's intelligence came under my observation as I was walking among the crumbling arches of Caracalla's baths in Rome, in April, 1882. When near the walls, a stone nearly as large as my fist fell at my feet. Fearing a recurrence of what I supposed was an accident of perishing masonry, our party went farther toward the centre of the area. A second and a third fell near us; and, looking up, I saw some crows circling above our heads, one of which dropped a fourth from his claws. It seems that we had been strolling too near their nests in the walls; and they took this method to drive us away, — a very effectual one, as a stone of that size, falling from the height of sixty feet, was an exceedingly dangerous missile, and perhaps only prevented from being fatal by the failure of the bird to make allowance for the impetus given by its own motion. The aim was accurate, and the discharge right overhead; but, as both we and the bird were moving, it fortunately missed its mark.

SAMUEL KNEELAND.

Paleolithic man in Ohio.

In SCIENCE of April 13, p. 271, Professor Wright remarks that "no paleolithic implements have as yet been found [in Ohio], but they may be confidently looked for." It has seemed to me possible, from my own studies of the remains of paleolithic man in the valley of the Delaware River, that traces of his presence may only be found in those river-valleys which lead directly to the Atlantic coast, and that paleolithic man was essentially a coast-ranger, and not a dweller in the interior of the continent. If we associate these early people with the seal and walrus rather than with the reindeer, and consider them essentially hunters of these amphibious mammals rather than of the latter, it is not incredible. I submit that they did not wander so far inland as Ohio, nor even so far as the eastern slope of the Alleghanies; and we need not be surprised if paleolithic implements, concerning which there can be no doubt whatever, — for recent Indians made and used stone implements that are 'paleolithic' in character, — are not found in Ohio, or even in Pennsylvania west of the valley of the Susquehanna River.

Unquestionable evidences of paleolithic man in America have been found in the valleys of the Connecticut, Delaware, and Susquehanna Rivers, and probable traces of the same people in the valleys of the Hudson, Potomac, and James Rivers. This is an extensive range of territory, and one not too limited as the probable area occupied by a primitive people.

If we could accept without qualification the assertion occasionally made, that America's earliest race was pre-glacial, the difficulties that beset the study of paleolithic man would quickly vanish. I am disposed to believe it, upon theoretical grounds, but have met with no satisfactory demonstration that such was the case. In a recent lecture before the Franklin institute of Philadelphia, Prof. H. Carvill Lewis remarked, "That man existed before the glacial epoch has been inferred from certain facts, but not satisfactorily proven."

Accepting the above conclusion, and coupling it with the assertion made by both Professors Wright and Lewis, that the melting of the great continental glacier occurred so recently as ten thousand years ago, we are compelled to crowd several momentous facts in American archeology into a comparatively brief space of time; and it becomes more probable that the fabricators of the implements found in post-glacial gravels came from some transatlantic continental area, and had not wandered far inland when met by southern tribes, who drove them northward, exterminated or absorbed them.

On the other hand, if the relationship of paleolithic man and the Eskimo is not problematical, and the latter is of American origin, then I submit that man was pre-glacial in America, was driven southward by the extension of the ice-sheet, and probably voluntarily retreated with it to more northern regions; and, if so, then in Ohio true paleolithic implements will surely be found, and evidences of man's pre-glacial age will ultimately be found in the once-glaciated areas of our continent.

CHAS. C. ABBOTT.

The copper-bearing rocks of Lake Superior.

Mr. Selwyn's courteous reply in SCIENCE, No. 8, to my letter in No. 5, calls for only a few remarks from me.

In his admission that I am right in asserting the existence of a great unconformity in the St. Croix region, between the basal sandstones of the Mississippi valley and the copper-bearing rocks, he yields the principal point for which I contend. It seems very unreasonable to me to extend the term 'Cambrian' over this unconformity; but, in the absence of any fossil evidence, I am relatively indifferent on this point. I only insist on the complete distinctness of the copper-bearing strata from the lowest sandstone of the Mississippi valley, and from the horizontal sandstone of the eastern end of the south shore of Lake Superior. Mr. Selwyn evidently does not appreciate that the St. Croix valley unconformity is not merely 'locally very great.' Our conclusions as to this unconformity are not based on any one local unconformable contact, but upon the fact, that, for a distance of over fifty miles in a north-westerly to south-easterly direction, the basal sandstone of the Mississippi valley lies horizontally athwart the courses of the tilted Keweenawan beds, overlying and burying the western termination of these beds, which are here disposed in synclinal form. Nor is the St. Croix Falls locality, described in the third volume of the Geology of Wisconsin, the only place in the St. Croix valley where the unconformity may be actually seen. Besides other places, it may be finely seen on Snake

and Kettle rivers, in Minnesota, where the Keweenawan beds are identical in all respects, even to the occurrence of interbedded porphyry-conglomerates and cupriferous amygdaloids, with those of Keweenaw Point.

As to the Animikie group, I have only to say, that I have not asserted its identity with the so-called Huronian rocks on the east shore of Lake Superior, spoken of by Mr. Selwyn, but merely its *probable* identity with the original Huronian of the north shore of Lake Huron, which neither I nor Mr. Selwyn have seen, and its certain identity with the iron-bearing schists of the south shore of Lake Superior. The term 'Huronian' has been so differently used by different members of the Canadian geological corps since the first establishment of the system, that much doubt must still remain as to whether there are two sets of schistose rocks north of Lake Superior, or not. This much, however, I regard as certain; viz., that the flat-lying Animikie rocks of Thunder Bay and northern Minnesota were once continuous with *some* of the folded schists lying north of them in northern Minnesota and Canada,—the Vermilion Lake iron-bearing schists, for instance,—although now separated from them by belts of gneiss and granite. The lithological differences between the Animikie rocks and the folded schists are often more apparent than real; while, in many respects, there is a very close lithological likeness. However, I do not expect, and indeed have no right to expect, acquiescence in my novel position as to the Animikie rocks until the evidence I have collected has been published. I am confident, that, with the evidence that I now have, in his hands, Mr. Selwyn would at least think the matter worth looking into.

With regard to the occurrence of volcanic ash in the Keweenaw series, I must acknowledge at once, that, so far as field-experience goes, Mr. Selwyn is far better equipped than I to judge of such materials, and that, not having seen Michipicoton Island, I am bound to accept his statement. I understood his first letter to indicate the occurrence of such ash in places which I had myself seen. Nevertheless, I bear in mind that a considerable school of English geologists has been long in the habit of calling almost any detrital rocks, not distinctly quartzose and associated with eruptive rocks, *volcanic ash*, when very often, at least, they might be simply derived by water-action from these rocks. Possibly there is some misunderstanding in our use of the term. Most of the detrital rocks of the Keweenaw series are volcanic detrital matter, in that they have been derived by water-action from the eruptive, massive rocks of the same series; but I used the term as applied to fragmental material produced by the volcanic action itself. I do not know of any *proof* of such an origin in stratified material, other than the vesicular character, and perhaps constant angularity, of the particles, which proof I have failed to find.

The discussion of such a question as the present one evidently cannot, however, be carried on satisfactorily in the pages of a journal; and I must ask my scientific *confrères* to defer their judgment until my publications on this subject, now in type, are issued. R. D. Irving.

University of Wisconsin,
April 12, 1883.

Pairing of the first-born.

As regards the pairing of the first-born, my calculation of which called forth Mr. Hendricks's criticism, permit me to call attention to the following letter from Mr. Edmands, which I hope will set the matter straight. I applied to Mr. Edmands, because mathematics is not my *fach;* and I now have the pleasure of thanking him for the very kind attention he has given this matter. Charles Sedgwick Minot.

Boston, April 24, 1883.

As J. E. Hendricks remarks in Science of April 13, p. 278, "the chance that the first-born male will pair with the first-born female is as one to ten;" but Dr. Minot's argument in Science of March 16, p. 165, depends upon "the probability of both parents" being first-born, as stated at the beginning of the last paragraph on p. 165. If we first restrict the case to the offspring of first-born males, the chance that both parents will be first-born is evidently one in ten. But in the remaining ninety per cent of the race there would be no case of both parents being first-born. Taking the race as a whole, out of one hundred pairs, one pair would be both first-born, nine would have the male only first-born, nine the female only, and eighty-one (9×9) neither male nor female first-born. This does not touch the question whether Dr. Minot is justified in giving no weight to the eighteen cases in a hundred, where only one individual of the pair is first-born. J. Rayner Edmands.

Cambridge, April 19, 1883.

Place the ten females in a row, and the ten males opposite them, with the 'first-born' opposite each other. The ten males are susceptible of $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10$ permutations, each of which furnishes a distinct system of pairing. Of these, $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9$ are possible without disturbing the juxtaposition of the first-born. The chance of their pairing will therefore be,

$$\frac{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10} = \tfrac{1}{10},$$

as stated by Dr. Hendricks in Science, April 13, p. 278. Mr. Minot's solution is correct only upon the supposition that *one pair, and no more,* will be formed. T. C. M.

JAMES CLERK MAXWELL.

The life of James Clerk Maxwell; with a selection from his correspondence and occasional writings, and a sketch of his contributions to science. By Lewis Campbell and William Garnett. London, *Macmillan & Co.*, 1882. 16+662 p., 3 portr., 4 pl., facsim., etc. 8°.

James Clerk Maxwell was born in Edinburgh on the 13th of June, 1831. He died Nov. 5, 1879.

The late Professor Benjamin Peirce once said in the hearing of the writer, that great geometricians did their best work before they had reached their fortieth year. This can hardly be said of the mathematical physicist; for the constant accumulation of new facts tends to make mature years the most fruitful in results to the student who still preserves his mental and physical activity. Commoner men doubtless, in time, make good the premature loss to the world of a genius. Those epochs, however, in a nation's history, in which men of

scientific genius live to a mature old age, will always be considered important ones.

Maxwell was fortunate in possessing a father who early perceived the genius of his son, and directed his mind toward the study of mathematics and physics. He was also fortunate in springing from a race in which ability seemed to be hereditary. 'The Clerks' for two centuries had been associated with all that was most distinguished in the northern kingdom, from Drummond of Hawthornden to Sir Walter Scott. John Clerk, the father of James Clerk Maxwell, the subject of the present sketch, succeeded to the property of Middlebie, which descended to him from his grandmother, Dorothea, Lady Clerk Maxwell, and assumed the name of Maxwell. It is related of him, that he took the greatest interest in science, especially in practical science. In a letter to his son, then at Cambridge, who proposed to spend the Easter holidays at Birmingham, he wrote, "View, if you can, armorers, gun-making and gun-proving, sword-making and proving, *papier-maché* and japanning, silver plating by cementation and rolling, ditto electrotype, Elkington's works, braziers' works by founding and by striking out in dies, turning, spinning teapot bodies in white metal, making buttons of sorts, steel pens, needles, pins, and any sorts of small articles which are cunningly done by subdivision of labor and by ingenious tools. Glass of sorts is among the works of the place, and all kinds of foundry-works, engine-making, tools and instruments, optical and [philosophical], both coarse and fine."

His acme of festivity was to go with a boon friend to a meeting of the Edinburgh royal society. It is said by those who knew both parents, that the element of practicality entered very largely into their natures. The fine spirit of genius, the great imaginative powers, were not especially evident in them. Perhaps if the father had had the speculative mind of the son, he might have turned him toward philosophy and literature. The possession, in the father, of great interest in practical and useful processes, doubtless influenced the son's future.

At an early age Maxwell showed that he inherited the curiosity of his father in regard to machines and the phenomena of nature. It is related, that, when he was two years and ten months old, "he has great works with door-locks, keys, etc.; and 'Show me how it doos' is never out of his mouth." Throughout his childhood his constant question was, 'What's the go o' that?' He was especially interested in colors. 'That (sand) stone is red; this (whin) stone is blue.' — 'But how d'ye know it's blue?' His aunt, Miss Cay, was heard to remark "that it was humiliating to be asked so many questions one could not answer, by a child like that." The picture given of the boy's pursuits —his great activity of body and mind; his delight in nature's moods; his love for the deep brown of the brook, the shifting play of light on the foliage, the colors of the wandering clouds; his moods of lying on his back, watching the clouds, and 'wondering' — shows the boy as father of the man. On stormy days he read voraciously every book within his reach, or spent his time in drawing, or inventing curious combinations of colors. The specimens of his early drawings show that he had an accurate eye, which might have made him an artist of fair talent. At the age of ten his tutor pronounced him slow to learn, probably judging him by old scholastic methods, which were ill fitted to bring out the child's tastes; and his father accordingly placed him at the academy in Edinburgh. Here the boy, who had been brought up apart from other boys, and had been accustomed to '*gang his own gate*' with youthful fancies unridiculed by the average unpoetical schoolboy, was much persecuted at first by his school-fellows, who were amused by his singular clothes and broad accent. He gradually made a place for himself, however, and discovered that Latin was worth learning, and Greek very interesting. It is related that he took the foremost place in Scripture biography and in English. In arithmetic, as well as in Latin, his comparative want of readiness kept him down. At the age of thirteen he remarks in a letter, "I have made a tetrahedron and a dodecahedron, and two other hedrons whose names I don't know." At this time he had not begun geometry; yet he had discovered for himself the nature of the five regular solids, and had also constructed out of pasteboard other symmetrical polyhedra.

His sense of humor is early apparent. In one of his letters, written at the age of eleven, he writes concerning his place in the class, "Talking about places, I am fourteen to-day, but I hope to get up. Ovid prophesies very well when the thing is over, but lately he has prophesied a victory which never came to pass." He enjoyed writing letters with curious illustrations drawn with pen on the margins, and subscribed himself Jas. Alex. McMerkwell, an anagram of his name. In one of these letters there is the first inkling of his poetic taste: "I made four lines of Latin one week. . . . But I am not going to try for the prize, as, when I lithp in numberth, it ith but a lithp, for the numberth do not come. . . .

But I am making English ones on the apparition of Creusa to Aeneas.

"O father! can it be that souls sublime
Return to visit our terrestrial clime?"

The story of his school-years, told in his life, is of great interest to the American boy who has been fitted for college at the old Latin school in Boston, or at the ordinary American academy. Writing Latin verses was a marked feature of the academy at Edinburgh. This practice is comparatively unknown in our schools and academies. The present writer remembers that the subject of geometry was finished, so to speak, in the Boston Latin school in 1863, in about three months. In the Scottish academy the boy's mind was evidently allowed to rest upon the subject much longer, and he was stimulated to do problems of a more or less inventive kind. It was said of Maxwell at the age of fifteen, that, from "some mathematical principle, he would start off to a joke of Martinus Scriblerus, or to a quotation from Dryden, interspersing puns and other outrages on language of the wildest kind, humming and hawing in spite of P——; or, in a quieter mood, he would tell the story of Southey's Thalaba, or explain some new invention." This seems to show that the Scotch boy had a wider intellectual atmosphere around him than falls to the lot of the average American boy. But Maxwell, it may be remarked, was not an average Scottish boy. At the age of fourteen he gained the prize for English verse, for a poem on the death of the Douglas, and also the mathematical medal.

At the age of fourteen he was much attracted to the subject of decorative painting, especially to the attempts of those who sought to reduce beauty in form and color to mathematical principles, and often discoursed upon the Greek patterns and on the forms of Etruscan urns. The consideration of this subject led him to contrive methods of drawing a perfect oval, and ovals in general. His father, who had watched his son's intellectual development with sympathetic interest, took his son's ovals to Professor James O. Forbes, of the University of Edinburgh, who thought that the simplicity and elegance of the boy's method entitled it to be brought before the Royal society. In the diary of the father we read, "M. 6. — Royal society with James. Professor Forbes gave account of James's ovals. Met with very great attention and approbation generally." From this time the boy evidently studied geometry by the inventive method, to which the father of Mr. Herbert Spencer has deservedly called attention.

Maxwell entered the University of Edinburgh at the age of sixteen. It is said of him at that time, that the originality and simplicity of his ways occasioned some concern to his conventional friends. He had a rooted objection to the vanities of starch and gloves. While at table he had an abstracted manner, as if occupied in studying the effects of refracted light in the glasses, or in devising some curious way of viewing objects. His aunt used to recall his attention by crying, 'Jamsie, you're in a prop' (mathematical proposition). His teachers had formed the highest opinion of his intellectual powers; and his companions enjoyed his quaint humor, and began to appreciate his high moral qualities, which were exemplified by his deep reverence for higher things, and his devotion to friends and to those who were suffering.

Between the ages of sixteen and nineteen he studied at the University of Edinburgh. His studies were multifarious; but he was especially interested in polarized light, the stereoscope, galvanism, rolling curves, and the comparison of solids. His paper on rolling curves was presented to the Edinburgh Royal society, Feb. 19, 1849, by Professor Kelland; "for it was not thought proper for a boy in a round jacket to mount the rostrum there." A paper on the equilibrium of elastic solids was also presented in the spring of 1850. It is related of him at this time, that he was regarded as a discoverer in natural philosophy, and a very original worker in mathematics. He is said to have felt the importance of cultivating the senses, and to have regarded dulness in that respect as a bad sign in any man. It is curious to notice, that he took great interest in the lectures of Sir William Hamilton on metaphysics. The views of the latter on the inferiority of the study of mathematics as a means of discipline to the study of philosophy and the classics, apparently did not diminish Maxwell's interest in the lecturer. The editor of the life of Maxwell remarks, in regard to Maxwell's interest in the lectures of Hamilton, "This is perhaps the most striking example of the effect produced by Sir William Hamilton on powerful young minds, — an effect which, unless the best metaphysicians of the subsequent age are mistaken, must be out of all proportion to the independent value of his philosophy."

It is a noticeable peculiarity of great mathematicians, that their latter years are much given to metaphysics. With Maxwell, however, the reverse was true. While at the University of Edinburgh, he seemed to be as

much attracted toward the study of metaphysics as toward mathematics, but hardly as much as to physics. As he grew older, the study of physics seemed to him more fruitful than that of mental philosophy.

His method of studying mathematics is often alluded to in his letters. Thus, in a letter to a friend, written at the age of sixteen, he says, "I read Newton's Fluxions in a sort of way, to know what I am about in doing a prop. There is no time of reading a book better than when you need it, and when you are on the point of finding it out for yourself, if you were able." Again, in another letter, in speaking of the division of his time: "Then I do props, chiefly on rolling curves, on which subject I have got a great problem divided into orders, genera, species, varieties, etc." He continually talks of doing 'props,' and apparently had a number upon which his mind was continually exercised. Nor was his method of studying physics less suggestive. In a letter dated Glenlair, July 5, 6, 1848, we read, "I have regularly set up shop now, above the wash-house at the gate, in a garret. I have an old door set on two barrels and two chairs, of which one is safe, and a skylight above, which will slide up and down. On the door (or table) there is a lot of bowls, jugs, plates, jam-pigs (jars), etc., containing water, salt, soda, sulphuric acid, blue vitriol, plumbago ore, also broken glass, iron and copper wire, copper and zinc plate, beeswax, sealing-wax, clay, rosin, charcoal, a lens, a Smee's galvanic apparatus, and a countless variety of little beetles, spiders, and wood-lice, which fall into the different liquids, and poison themselves. . . . I am making copper seals, with the device of a beetle. First I thought a beetle was a good conductor: so I embedded one in wax (not at all cruel, because I slew him in boiling water, in which he never kicked), leaving his back out; but he would not do. Then I took a cast of him in sealing-wax, and pressed wax into the hollow, and black-leaded it with a brush; but neither would that do. So at last I took my fingers and rubbed it, which I find the best way to use the black lead. Then it coppered famously. I melt out the wax with a lens, that being the cleanest way of getting a strong heat: so I do most things with it that need heat." He was busy at this age with experiments on polarized light and on colors. "I have got plenty of unannealed glass of different shapes; for I find window-glass will do very well, made up in bundles. I cut out triangles, squares, etc., with a diamond, about eight or nine of a kind, and take them to the kitchen, and put them on a piece of iron in the fire one by one. When the bit is red-hot, I drop it into a plate of iron sparks to cool; and so on till all are done."

The years he spent in the University of Edinburgh were full of what might be called original work. He studied under Professor Forbes and Professor Kelland, and worked, "without any assistance or supervision, with physical and chemical apparatus." In 1850 he left Edinburgh for Peterhouse college, Cambridge, and, after a short residence in this college, left it for Trinity, in the expectation that the larger college would afford him ampler opportunities for self-improvement. His tutor says of him in 1853, "It appears impossible for Maxwell to think incorrectly on physical subjects." He looked upon him as a great genius, with all its eccentricities, and prophesied that one day he would shine as a light in physical science. This impression was shared, apparently, by students who were the friends of Maxwell. He seemed at this period to be in great spirits, and to thoroughly enjoy his college-life. At no time a narrow specialist, he opened his mind, while at Cambridge, to all the intellectual influences of the place. He became one of the club known as the 'Apostles.' He sought the society of classical men as well as that of the mathematicians. His progress at the university was watched by his father with keen and sympathetic interest. In a letter he writes, "Explain the pendulum experiment to me. You used often to speak of the retardation of the rotation of the earth by the friction of the tides. What is the phosphate of lime theory of mental progress?" And again: "Do you like the trig. lectures A? Tacitus is not new to you. His style must be congenial to a deep, half-sentence lecturer. You seem to have great gayeties with college parties with scientific dons. Do you take note of Stokes's experiments on the bands of the spectrum? Will they be suitable for repetition in the garret of the old house?"

The intimacy of the father and son, touched upon here and there in the life of the son, was a beautiful one. Maxwell's nature was capable of great devotion, and his feelings were exquisitely sensitive to kindness. His love for animals was but one expression of this abundant humanity. The editor of his life says, "In the autumn of 1850 the neighboring estate of Upper Corsock had been let to a shooting-party, one of whom remarked to me, what a pity it was that young Mr. Clerk Maxwell was 'so little suited for a country life.' I clearly recollect his look of exulting mirth when this

was repeated to him. . . . The moral of Wordsworth's Hart-leap well was not so much a principle as an instinct with him. I remember his once speaking to me of the subject of vivisection. He did not condemn its use, supposing the method could be shown to be fruitful, which at that time he doubted; but 'couldn't do it, you know,' he added, with a sensitive, wistful look, not easy to forget."

In his twenty-first year his poetical side and religious side found greater expression than before, and his great strength in mathematics made itself felt. It is related that he often shortened the long train of analysis of the tutor by giving a short geometrical solution; and, whenever the subject admitted, he had recourse to diagrams rather than to analysis. At the age of twenty-two, Maxwell was second wrangler, Routh being senior; and Routh and Maxwell were declared equal as Smith's prizemen. At this age we find him speculating upon electricity and magnetism, and engaged in researches on color.

At the age of twenty-five Maxwell was appointed professor of natural philosophy at Marischal college, Aberdeen. At this period of his life he began his paper on the structure of Saturn's rings. His letters at this period are extremely suggestive. The death of his father, and his engagement to Miss Dewar, daughter of Principal Dewar, gave a characteristic coloring to them. These great events in his life had a powerful influence upon his speculations. His devotional side found full expression; and the study of ethics and metaphysics seemed to be strongly controlled by that of science.

He writes after his engagement, —

"My lines are so pleasant to me that I think that everybody ought to come to me to catch the infection of happiness. This college-work is what I and my father looked forward to for long; and I find we were both right, — that it was the thing for me to do."

In the same letter he remarks, —

"I have observed that the practical cultivators of science (e.g., Sir J. Herschel, Faraday, Ampère, Oersted, Newton, Young), although differing excessively in turn of mind, have all a distinctness and a freedom from the tyranny of words, in dealing with questions of order, law, etc., which pure speculators and literary men never attain."

The period of Maxwell's life extending from twenty-nine to forty was very rich in intellectual work. His calculations upon the character of Saturn's rings led him to speculate upon the molecular theory of gases. In 1860 he presented a paper on Bernoulli's theory of gases to the British association; in 1862 we find him engaged with others in determining the electrical unit of resistance; he was also occupied upon an investigation of the ratio between the electromagnetic and electrostatic units of electricity; and his great work on electricity and magnetism was in progress. He speaks in his letters of wading through the works of German mathematical writers, and of the careful study of the results of Faraday. His intercourse with the latter was of the pleasantest character.

On one occasion he was wedged in a crowd attempting to escape from the lecture-theatre of the Royal institution, when he was perceived by Faraday, who, alluding to Maxwell's work among the molecules, accosted him in this wise: —

"Ho, Maxwell, cannot you get out? If any man can find his way through a crowd, it should be you."

The influence of Faraday's intellectual methods of thought can be plainly traced in Maxwell's later writings upon electricity. No one can understand Maxwell's intellectual growth at this time who has not read his great treatise on electricity and magnetism. In this book are embodied the results of long and continued study of the observed phenomena, and of the best methods of interpreting them by mathematics. In this treatise one can find his electromagnetic theory of light, upon which he spent much thought during this busy period of his life.

In 1870 he was appointed director of the Cavendish physical laboratory at Cambrige by the *consensus* of eminent men whose advice had been asked in regard to the best man for the position. Lord Rayleigh, who succeeded Maxwell as director, wrote to him at this time, —

Cambridge, Feb. 14, 1871.

"When I came here last Friday, I found every one talking about the new professorship, and hoping that you would come . . . What is wanted by most who know any thing about it, is not so much a lecturer as a mathematician who has actual experience in experimenting, and who might direct the energies of the younger fellows and bachelors into a proper channel . . . I hope you may be induced to come: if not, I don't know who it is to be."

Maxwell, in a letter to the vice-chancellor of Cambridge, expressed the opinion that the "special researches connected with heat, which I think most deserving of our efforts at the present time, are those relating to the elasticity of bodies, and, in general, those which throw light on their molecular constitution; and the most important electrical research is the de-

termination of the magnitude of certain electric quantities, and their relations to each other." The Cavendish physical laboratory was not opened until 1874. Maxwell died in 1879, five years later. In this short term of office he left the impress of his genius upon the scientific work of Cambridge. Sir William Thomson has said, "There is, indeed, nothing short of a revival of physical science at Cambridge within the last fifteen years, and this is largely due to Maxwell's influence." We have said that no one can thoroughly appreciate the genius of the man who has not read his treatises on electricity, on heat, and his various essays, which are soon to be collected and published.

His life, with its great expressions of reverence for higher things and its respect for true scientific work, is one to ponder over; and his correspondence is rich in literary suggestions, and enlivened by the play of humor. It will always be a source of gratification to Americans to know that the American academy of arts and sciences and the American philosophical society were the first of the foreign scientific societies to elect Maxwell a foreign honorary member.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

The polar quadrilateral. — Given a conic and a polar quadrangle: the five quadrilaterals got by taking the poles of its vertices, or the pole of one vertex and the lines joining the other three, are polar quadrilaterals such that conics circumscribing their diagonal triangles osculate the given conic in the same six points. S. Kantor gives a geometrical proof of this theorem by showing that the six points in which a conic inscribed in a quadrilateral can be made to touch the given conic are the same for the five quadrilaterals, and that any one of the triply infinite number of conics with respect to which a fixed quadrilateral is polar osculates other conics of the system in the same six points in which it is touched by conics inscribed in the quadrilateral. He points out an application of the latter property to the determination of the points of inflection of the unicursal quartic obtained by a quadric transformation of the conic. — (*Math. ann.*, xxi. 299.) C. L. F. [754

Theory of functions. — The second part of a paper by Rausenberger treats of single valued functions with non-interchangeable periods. It is not convenient here to do more than refer to this paper, as a review of it can hardly be given without introducing a good deal of algebraical work. The paper, however, as introducing a certain number of new and interesting ideas, is decidedly worthy of consideration. — (*Math. annal.*, xxi.) T. C. [755

Impact of billiard-balls. — M. Resal has generalized some of the results obtained by Coriolis in his *Théorie analytique des effets du jeu de billard.* Coriolis has considered the two balls as being homogeneous, and possessing identical properties in every respect. M. Resal takes account of possible differences in the masses of the two balls, and in their moments of inertia with respect to a diameter, — two properties which might interfere very seriously with the play of even a skilful player. One of the principal results obtained by M. Resal is, that, during the instant of impact, the direction of the friction is not constant. The contrary was assumed by Coriolis. — (*Comptes rendus*, Oct. 16, 1882.) T. C. [756

PHYSICS.

Acoustics.

Vibrations of membranes. — A. Elsas has studied the vibrations of both square and circular membranes, exciting them by connecting the middle of the membrane with a tuning-fork by means of thread, attaching the thread to the membrane with sealing-wax. The nodes and loops were determined in the usual manner by the use of sand and lycopodium powder. Thirty different forks were used, and a great variety of membranes. The sound-figures showed a gradual change from one mode of vibration to another as the pitch of the fork was changed, thus verifying the results of Savart. — (*Beibl. ann. phys. chem.*, No. 2, 1883.) C. R. C. [757

Photography of sound-vibrations. — Boltzmann has studied the vibrations of a plate actuated by the voice, using a method similar in many respects to that employed several years ago by Prof. Blake of Providence. A thin platinum plate was attached perpendicularly to the iron plate; and, by an application of the principle of the photophone, it was shown to vibrate in the same manner as the iron plate. By means of a solar microscope, an image of the shadow of the platinum plate was thrown upon a screen, the straight bounding-line of the shadow being condensed by a cylindrical lens. The screen was then replaced by a sensitized plate, moved rapidly at right angles to the line of light produced by the cylindrical lens, while the iron plate was made to vibrate by the voice. The bounding-line between light and shadow on the plate formed a curve whose nature varied according to the sound uttered. The curves due to the vowels are simple; those due to consonants, much more complex. — (*Phil. mag.*, Feb.) C. R. C. [758

Optics.

Conditions of sight which affect accurate shooting. — Formerly the sight of a soldier as regards shooting was a matter of little consideration; but with the introduction of the Martini-Henry and other rifles, which are accurate at 1,500 yards, sound eyesight becomes an important element. Dr. Litton Forbes, surgeon-major in the Servian war, discusses the various changes taking place in the eye by which the sight is affected, and proposes to correct defective vision by means of a stenopaeic sight-adjuster. This consists of a disk of colored glass, perforated with a pin-hole aperture, having a correcting-lens of colorless glass cemented to its back. The whole is to be worn in a spectacle-frame. — (*Journ. roy. united service inst.*, no. 118, 1882.) C. E. M. [759

A new optical phenomenon. — Axenfeld describes the conditions of an experiment in which straight lines, a little on the near or far side of the

distance for which the eye is focused, appear curved. The explanation of the phenomenon is essentially the same as that of 'Scheiner's experiment.' The author suggests that it may be employed in the construction of an optometer. — (*Pflüg. archiv*, xxx. 288.) H. N. M. [760

Heat.

Thermometry. — In a recent communication Prof. Cleveland Abbé has reviewed the subject of the determination of the temperature of the air at a given locality, and described an original device. Beginning with the simple hanging of the thermometer in the open air, he proceeded to describe and point out the defects of the various methods of exposure of the past and present, — the thermometer in the shade, the Glaisher screen, the Stevenson screen and double-louvre screens in general, the double metallic cylinder shelters of Jelinck and Wild, the silver-thimble screen of Regnault, the whirling thermometer of Saussure and others, and Joule's method. The method devised by himself in 1865, and practised for a short time at Pulkova, consisted in constructing a very perfect louvre screen, within which were established black-bulb and bright- or silvered-bulb thermometers. One of these was greatly influenced by radiations from the surrounding screen, and the other very little; and the difference of their readings enabled the effect of radiation to be computed and eliminated. Provided the theory of the action of the bright and black bulbs is perfectly understood, they can be employed in conjunction by meteorologists and physicists without a screen, and even in sunlight.

The formula used for reduction at Pulkova was

$$t_a = t_s + c(t_b - t_s),$$

in which t_a is the temperature of the air, t_s and t_b are the readings of the bright-bulb and black-bulb thermometers, and c is a co-efficient to be determined experimentally for each pair of instruments. Quite recently Prof. William Ferrel has made a theoretic investigation of the co-efficient, showing that it is not strictly constant, but varies with the velocity of the air-current passing the bulbs. Representing by r_s and r_b the radiating powers of the bright and black bulbs, by B, B', and B'', certain constant co-efficients depending on the size, conductivity, and specific heat of the bulbs, and by v the velocity, he writes the full formula thus: —

$$t_a = t_s + \frac{1 + \dfrac{Br_b}{B' + B''v}}{\dfrac{r_b}{r_s} - 1}(t_b - t_s).$$

— (*Phil. soc. Wash.*; *meeting* March 24.) [761

Electricity.

Determination of surface of winding. — F. Himstedt gives a method of determining experimentally the *windungsfläche* of a bobbin by suspending it in the magnetic meridian, and comparing the deflection due to a given current with that due to another current in a coil whose constants can be directly measured. By hanging the two coils rigidly connected upon the same suspension, and passing the current first in the same and then in opposite directions through the coils, he obtains

$$\frac{S + s}{S - s} = \frac{I' \tan \phi}{I \tan \phi'},$$

where ϕ represents the deflection when the current is in the same direction. This formula renders necessary only the measurement of four angles. The paper of F. Kohlrausch which suggested this is given in full in *Ann. phys. chem.*, iv. — (*Ann. phys. chem.*, iii.) J. T. [762

Telephony. — At a recent meeting of the Society of telegraph engineers and of electricians, J. Munro described some new forms of microphonic transmitters. Among them was one consisting of two pieces of wire gauze held together by a magnet. In another form the microphonic contact was between the links of a short stretched chain. No details of practical trials are given. Mr. Stroh described an experiment in which he showed, by the use of a mirror and screen, that, in the case of one carbon cylinder resting across another, the upper one was raised $\frac{1}{2,000}$ mm. during microscopic contact. — (*Electrician*, March 17.) J. T. [763

The Ayrton and Perry erg-meter. — Professor Perry gives a proof of the principle of the erg-meter, which measures the work done by a current by means of its electro-magnetic retardation upon a pendulum-bob. — (*Ibid.*) J. T. [764

Conti's system for neutralizing induction. — One of two parallel wires is bent upon itself at one point of its course into a long, rectangular loop. The current in the outer side of this rectangle is opposite to that in the straight part of the wire, and may be brought near enough to a neighboring line to neutralize the mutual induction. — (*Electr. rev.*, Feb. 24.) J. T. [765

CHEMISTRY.

(*Organic.*)

The hydroxylamine reaction. — Generalizations of this reaction are still in progress in the laboratory of V. Meyer. E. Nägeli obtained from mesityloxide, mesityloxime ($C_6H_{10}{=}NOH$); from phoron, phoronoxime ($C_9H_{14}{=}NOH$); from allylacetone, allylacetoxime ($C_6H_{10}{=}NOH$); and from suberone, suberoxime ($C_7H_{12}{=}NOH$). Of still greater interest was the formation from camphor of camphoroxime, —

$$C_{10}H_{10}O + NH_2OH = H_2O + C_{10}H_{16} = NOH.$$

This reaction is a strong indication of the ketone character of camphor. Hydroxylamine was without action upon borneol and menthol. With chloroform the following reaction took place: —

$$\underset{\text{Chloroform.}}{\begin{array}{c} CCl_3 \\ | \\ COH \end{array}} + 2NH_2OH = 2HCl + H_2O + \underset{\text{Monochlorglyoxime.}}{\begin{array}{l} Cl - C = NOH \\ \quad\;\; | \\ H \; - C = NOH \end{array}}$$

Max Wittenberg and V. Meyer employed the hydroxylamine reaction to prove the constitution of benzil and benzoin. If the formulae hitherto accepted are correct, two molecules of hydroxylamine should be absorbed by benzil, —

$$\begin{array}{c} C_6H_5 - CO \\ | \\ C_6H_5 - CO \end{array} + \begin{array}{c} NH_2OH \\ \\ NH_2OH \end{array} = 2H_2O + \begin{array}{c} C_6H_5 - C = NOH \\ | \\ C_6H_5 - C = NOH \end{array}$$

and one molecule by benzoin, —

$$\begin{array}{c} C_6H_5 - CO \\ | \\ C_6H_5 - CHOH \end{array} + NH_2OH = H_2O + \begin{array}{c} C_6H_5 - C = NOH \\ | \\ C_6H_5 - CHOH \end{array}$$

On trial it was found that one molecule only of hydroxylamine entered into the reaction in either case. To make sure that hydroxylamine acts the same upon the group $-CO-CO-$ as upon the group $-CO-CH_2-$, the reaction was tested with glyoxal, with the following results: —

$$\begin{array}{c} HCO \\ | \\ HCO \end{array} + \begin{array}{c} NH_2OH \\ \\ NH_2OH \end{array} = 2H_2O + \begin{array}{c} HC = NOH \\ | \\ HC = NOH \end{array} \text{(glyoxime).}$$

Benzil cannot, therefore, be a substituted glyoxal. These investigations will be continued in different directions to determine which of several possible formulae represents its constitution. — (*Berichte deutsch. chem. gesellsch.*, xvi. 494, 500.) C. F. M. [766

The alkaloids of nux vomica. — On heating brucine in sealed tubes with concentrated hydrochloric acid, W. A. Shenstone found that the tubes opened with great pressure, and that methyl chloride escaped in large quantity. The formula of brucine may be regarded as derived from that of strychnine, by replacing two hydrogen atoms in the latter by two methoxyl groups: —

$$\underset{\text{Strychnine.}}{C_{21}H_{20}(H_2)N_2O_2} \qquad \underset{\text{Brucine.}}{C_{21}H_{20}(CH_3O)_2N_2O_2}$$

For the purpose of testing this hypothesis, the decomposition with hydrochloric acid was performed on a quantitative basis, which gave 79 per cent of the amount required for two methoxyl groups. When the contents of the tubes were dissolved in water, alkalies precipitated a base which proved to be too unstable for examination. The results obtained with hydriodic acid were still less satisfactory. Experiments will be next tried with strychnine. — (*Journ. chem. soc.*, ccliii. 101.) C. F. M. [767

Certain substituted acrylic and propionic acids. — Dr. C. F. Mabery described several acids belonging to these series, which he had obtained in various ways. By the addition of chlorine to β-dibromacrylic acid, a dichlordibrompropionic acid ($C\,Br_2Cl - C\,H\,Cl - C\,O\,O\,H$) was formed, which will be designated as the γ-acid, to distinguish it from the α- and β-dichlordibrompropionic acids previously investigated. A molecule of hydrobromic acid was removed from the γ-acid by the action of aqueous baric hydrate, with the formation of a dichlorbromacrylic acid ($C\,Br\,Cl = C\,Cl - C\,O\,O\,H$). In like manner, from the α- and β-acids, baric hydrate removed hydrobromic acid, giving the corresponding substituted acrylic acids, whose structure is yet to be determined. It was hoped that a chlorine addition-product of brompropiolic acid could be formed, since it would serve as a means of comparison; but on trial it was found that four chlorine atoms were taken up, instead of two, forming tetrachlorbrompropionic acid ($C\,Br\,Cl_2 - C\,Cl_2 - C\,O\,O\,H$); melting-point, 225°. Chlorine was also absorbed by chlorbromacrylic acid. From the resulting trichlorbrompropionic acid ($C\,Cl_2Br - C\,H\,Cl - C\,O\,O\,H$) baric hydrate eliminated hydrobromic acid, with the formation of trichloracrylic acid ($C\,Cl_2 = C\,Cl - C\,O\,O\,H$). These substances will be submitted to further study. — (*Harvard chem. club; meeting* April 24.) [768

AGRICULTURE.

Rancid butter. — According to Hagemann, the peculiar properties of rancid butter are due to the presence of free butyric acid, and other volatile fatty acids. These are set free from the glycerides of the butter by the action of the lactic acid arising from the fermentation of the small quantity of buttermilk retained by the butter. That the liberation of butyric acid itself is not due to a fermentative action, was shown by the fact that all attempts to render butter rancid by adding to it the butyric ferment failed, and also by the fact that rancid butter failed to infect fresh butter. That the explanation given above is an adequate one, was shown by mixing both lactic acid and other dilute acids with butter or with pure butter-fat, the fat speedily becoming rancid in all cases. The same effect was produced on artificial butyrin. To prevent butter from becoming rancid, the buttermilk should, in the first place, be removed as thoroughly as practicable. In the second place, any thing which will prevent the lactic fermentation will, of course, remove the cause of the evil. The author does not enter into a consideration of the most suitable means of doing this, further than to point out that acids (such as salicylic acid) are not applicable, since they themselves are liable to act on the fat, and render it rancid. — (*Landw. vers. stat.*, xxviii. 201.) H. P. A. [769

Ropy milk. — Schmidt finds that the ropiness of milk, which is sometimes observed, is caused by the action of a microscopic organism, which he describes, upon the milk-sugar. The same organism acts also upon cane and grape sugar and on mannite, converting them into a substance resembling vegetable mucilage in its properties. Small quantities of acid are produced, but no carbon dioxide. The fermentation appears to resemble, if not to be identical with, the mucilaginous fermentation of wine. The organism acts most energetically at 30°–40° C., and is destroyed by heating the fluid containing it to 60° C. or over. Freezing does not destroy it; and, if dry, it withstands a temperature of 100° C. Only comparatively large quantities of antiseptics prevent its action.—(*Landw. vers. stat.*, xxviii. 91.) H. P. A. [770

GEOLOGY.

Geology of Brazil. — Professor Edward D. Cope made a communication based upon a collection of vertebrate fossils from Brazil, recently placed in his hands for study. As his examination of the material was not yet completed, he could only allude to the leading points of interest in connection with the geology of the United States and western Europe. The localities in which the fossils in hand were found are all south of the Amazon River. The eastern and western ranges of mountains correspond to our Alleghany and Rocky Mountains, and are approximately of the same age. A cretaceous formation is found in the neighborhood of Pernambuco. There are bare fossiliferous deposits near Sergipe, while the beds near Bahia are evidently lacustrine. The fossils from Pernambuco include several genera of sharks, and a genus of crocodiles identical with Hyposaurus of New Jersey. There is found with these a fine genus of rays, the teeth of which were described. These genera indicate this cretaceous formation to be near the top of the series, corresponding to the Maestricht chalk, or our number 5. At Maroin was found a new species of fish of the genus Pycnodus. He believed it to belong to the order Isospondyli; although it is very different in general form from the herrings, salmons, and other recent fishes belonging to the order. The form of the basilar bone of the pectoral fin, which the speaker considered of first-rate importance as indicating the relationship of the genus, was observed, and indicated that the position assigned was the correct one. The region about Bahia furnishes many fishes and saurians, but no cretaceous mammalia have as yet been discovered. There are two species of herring, — a small one, six inches long; and a large one, two feet long, resembling Hyodon and Chirocentrus. Crocodiles and dinosaurs are abundant, the former indicating higher beds than those at Pernambuco. A gavial resembling Holops of the New-Jersey cretaceous No. 5 was also found in these beds, which may be said to represent the Laramie deposits of the western United States. A tertiary horizon in Bahia has so far produced but one fossil, — a new species of Toxodon. The age is pampean. In San Paulo the beds seem to be Permian, and have yielded one batrachian form, which may, however, be carboniferous. The head bones of a large fish, the locality of which was not known, were also described. During the pliocene period the vertebrate fauna of Brazil was very distinct from that of North America; but the fossils now being studied

indicate a marked similarity in earlier periods. — (*Acad. nat. sc. Philad.; meeting* April 10.) [771

Lacustrine formations of St. John, N.B. — As studied in the deposits of Lawlor's Lake, G. F. Matthew finds these to have begun about the middle of the terrace period, when the sea, which had previously submerged this portion of the coast to a depth of 200 feet, had so far shoaled as to bring up the land within 65 feet of its present level. During the interval between this epoch and the present time, a series of layers has been deposited, resting upon the marine Saxicava (or Macoma) sands below, and consisting, in succession, of lacustrine clays, lacustrine peat, peaty marl, and pure marl, to a depth of about 81 inches. From the character and relations of the deposits, together with the vegetable and animal remains which they contain, he finds it possible to trace out a number of successive phases in the lake-history of the region, accompanied, probably, by equally marked climatic differences. Among the plant-remains observed, the most interesting are those of the Characeae, of which particular descriptions, accompanied by figures, by Dr. T. F. Allen, are given. In addition to the spores of Chara, fragments of wood (some of them gnawed by the beaver), bark, cones of evergreen trees, bud-scales and leaves, and fruits of several species of land-plants, occur. A small fragment of *charcoal* was also found some distance below the surface, indicating, probably, the presence of man. The character of the plants is regarded as presenting a more northern facies than those dwelling in the same region to-day. The variations of the molluscan fauna attendant upon the changes in the condition of the lake are especially interesting, and have been made the subject of particular study by Prof. Hyatt. — (*Bull. nat. hist. soc. N.B.*) L. W. B. [772

Lithology.

The Cheviot andesites and porphyrites. — The Cheviot district is composed largely of a series of quartzless eruptive rocks, to which the name 'porphyrite' is usually applied. They have a compact felsitic groundmass porphyritically enclosing numerous felspars. The color is generally dark purple or red. They are much altered; and amygdaloidal varieties are found. In addition to the ordinary porphyrites, there occur masses of volcanic ash and breccia, and also a rock known as pitchstone porphyrite. These porphyrites have been described by Teall under the name 'andesites,' regarding them as more or less altered andesites.

Mr. Teall describes the mineral constituents as felspar, pyroxene, magnetite or mennacanite (a glassy base containing various devitrification products), apatite, and hematite or biotite. The felspars contain numerous inclusions of the base, and are principally plagioclase. The pyroxene is in elongated, octagonal, and irregular crystals and grains. The crystals are sometimes twinned, and he regards them as augites. The inclusions in the augite are glass cavities and colorless microlites. The groundmass is described as a 'felted aggregation of microlites in a glassy base.' The present writer has preferred to denominate this as a 'felty base.' The microlites of the felty base Teall regards principally as felspar. The alteration products appear mainly to be siliceous. The age is stated to be 'post-silurian and pre-carboniferous.' Some specimens were later examined by Dr. H. Rosenbusch of Heidelberg, the leading European lithologist. He found that part of the pyroxenic constituent was orthorhombic, probably hypersthene, while the remainder is augite.

The constantly increasing discovery of other minerals besides augite, in the andesites, is leading, in the present system of nomenclature, to a series of distinct names for rocks structurally and chemically alike, and will probably in time cause the abandonment of the mineralogical nomenclature of rocks. In this case it should lead to the employment of the term 'andesite' alone. — (*Geol. mag.*, March, 1883.) M. E. W. [773

GEOGRAPHY.

(*Arctic.*)

Northern notes. — Later advices have been received from the British party at Fort Rae. After experiencing a miniature shipwreck on Great Slave Lake, they arrived at Fort Rae in the latter part of August. Sept. 1, meteorological, and, two days later, magnetic observations were begun. Winter set in Nov. 1. The minimum temperature of the air to Nov. 30 was — 43° C. The latitude of Fort Rae was determined to be 64° N., a degree farther north than previously supposed. Corrections in the position and shape of Great Slave Lake also seem necessary. The party were well, and work progressing favorably. They expect to return in October, 1883.

The plans of Baron Nordenskiöld for the present summer in Greenland have been in part made public. South-west Greenland is to be visited, and a study of the inland ice from that direction is contemplated. Later in the season, when the usual lane of water forms between the pack-ice and the south-east shore north from Cape Farewell, the party will proceed in *umiaks*, or sealskin canoes, as far as circumstances will admit, with the view of reaching, at the head of some of the fiords, the highlands which exist in east Greenland, and which are believed to be partly free from glaciers. Traces of the ancient Norse colonies at Öst-bygd are among the things to be sought for, though the present weight of evidence is in favor of the theory that these colonies were on the south rather than on the east coast, and that they are represented by the well-known stone ruins of south Greenland. — W. H. D. [774

Siberian notes. — Number four of the quarterly *Isvestia* of the imperial geographical society for 1882 (printed 1883) contains an article by N. S. Shtukin on 'Popular traditions of eastern Siberia,' which contains much interesting matter, and some amusing instances of ideas associated by the residents with certain ancient monuments. Another by the same author is, 'An explanation of certain picture-writings on the cliffs of the Yenisei River.' These are figured, but are not particularly remarkable, except as being the work of invaders from the far south, perhaps Persians. Camels and pheasants are among the animals represented. U. V. Arsenieff discusses the consequences of early publications on, and explorations of, the Amur River. Bussé continues his valuable (separately paged) bibliography of the literature of the Amur region. The first edition of this bibliography, containing 522 titles, appeared in 1874. The present edition is brought down to 1881, the forty-eight pages already published including 973 titles. The work, which will probably be completed in the next number, is announced to contain, in all, 1,416 titles, divided under appropriate subjective subheads, but catalogued by authors. Of the proposed bibliographies of Hoevert and of the academy of sciences, nothing has lately been heard, which makes the result of private enterprise so much the more welcome. Bussé's titles are condensed, but sufficiently full for reference, and a large proportion refer to articles in Russian periodicals. — W. H. D. [775

(Africa.)

Abbé Guyot on eastern Africa. — This enterprising missionary leader gives a summary of the difficulties encountered in entering Africa from Zanzibar in his several expeditions since 1879. His party included at times as many as six hundred persons, among whom brawls were very frequent, and desertion and robbery were prevented only by the strictest watch. In passing the numerous Ugogo villages, there was always delay and much palaver concerning the imposts collected of travelling parties. The fever presented the greatest danger. Sixteen of his thirty-five missionaries died of it in three years, and four more were killed by the negroes. Bad reports are spread by the Arabs about the Europeans, who are represented as woman-stealers and cannibals. The abbé bought and brought back with him four native children, who are now baptized and learning Latin, as preparation for the study of medicine; for as doctors they can exert the greatest influence. Guyot was considered a great magician, because he cured a native sorcerer who was unable to cure himself. It was hoped that the Louaha, flowing from the country east of the lakes to the ocean, might prove an easy means of communication with the interior; but it was found unnavigable. Large game was common, and gave plenty of food for cheap living for the caravans. The natives call '*gli, gli!*' when hunting the hippopotamus; and, if within hearing, it rises from the shallow, muddy banks of the river, and comes towards them. This was tried many times, and always proved successful. The friendly native tribes are good-hearted; but they must be allowed their own peculiar ways, such as shouting and dancing all night to do honor to the white travellers to whom they had presented food. The abbé hopes soon to go to western Africa, and ascend the Kongo. — (*Comptes rendus soc. géogr. Paris*, 1883, 44.) W. M. D. [776

Climate of the upper Senegal. — M. Colin, physician of Commandant Derrien's topographic party to the upper Senegal in 1880–81, divides the year there into a dry and a wet season, and two transition periods, — the dry season, from Nov. 15 or Dec. 1 to March 15, with nights and early morning hours cool, and days supportable; transition, from March 15 to May 15, still dry and healthy, but very warm and uncomfortable for Europeans; the rainy season, from May 15 to Oct. 15, cooler and often cloudy, without evaporation from the marshes, and hence still healthy; the second transition, from Oct. 15 to Nov. 15 or Dec. 1, still somewhat rainy, but with subsidence of rivers and drying of low plains, excessively unhealthy. — (*Comptes rendus soc. géogr. Paris*, 1883, 86.) W. M. D. [777

Country of the upper Niger. — Commandant Gallieni's second paper gives many details on the hydrography and population of this region, and a few notes on its geology. The rocks are chiefly horizontal sandstones, showing barren plateaus, separated by fertile valleys, in which the streams are subject to rapid and regular floods, rising in June, and falling in December. The Niger is considered in three parts. The upper stream begins at the rocks of Sotuba, ten kilometres below Bammako, and extends through the broken country to its head waters, but even here probably in part navigable for small steamboats. The middle course includes the least-known part of the river from the rocks of Sotuba to the falls of Busa. Here the stream flows in numerous channels through a flat country, which it enriches. An active river-trade in slaves, cattle, gold, etc., is carried on between large villages on its banks. This division is more navigable than the first. The lower course extends from the falls of Busa to the sea, and has often been ascended a considerable distance by trading-vessels. The total length is over 2,000 miles. Several of the towns described have well-constructed fortification walls, which are illustrated by plans and figures. On the assault of the village Gubanko in 1881, a hundred cannon-shot were needed to make a breach two or three metres wide. — (*Bull. soc. géogr. Paris*, 1882, 616.) W. M. D. [778

BOTANY.

Cryptogams.

Ohio fungi. — In a paper on the Mycologic flora of the Miami valley, Mr. A. P. Morgan has given descriptions of eighty species of Agaricus belonging to the division Leucospori, found in south-western Ohio. The paper is accompanied by four colored plates, in which are figured six new species of Agaricus. — (*Journ. Cinc. soc. nat. hist.*, vi.) W. G. F. [779

Diseases of trees. — The third part of the Untersuchungen aus dem forstbotanischen institut of Munich contains several articles on the diseases of woody plants caused by fungi. Dr. H. Mayr has a paper on the disease of maples, linden, and horse-chestnut, caused by Nectria cinnabarina. Prof. Robert Hartig describes a new species, Rhizomorpha (Dematophora) necatrix, which he considers to be the cause of the root-rot in grape-vines. The Rhizomorpha produces conidia, which are figured by Hartig; but he was unable to find ascospores of any kind. While recognizing that the root-rot is caused by a species of Rhizomorpha, he differs from Millardet and Frank, who consider that the Rhizomorpha is the same as R. fragilis, which develops into Agaricus melleus; and, on the other hand, he differs from Prillieux, Thuemen, and others, who attribute the rot to a growth of Roesleria hypogaea, which Hartig considers to be merely a saprophyte which occasionally develops on the diseased roots. Hartig calls attention to the fact that in Germany the white pine of the United States (Pinus strobus) is especially susceptible to fungous diseases, and mentions several destructive fungi which are prone to attack it: among others, he cites Peridermium pini. In this respect the experience of German mycologists does not agree with observations made in this country, where the white pine is apparently less liable than some other species to attacks of the Peridermium. — W. G. F. [780

Insects and the spermogonia of Uredineae. — For several years Ráthay has been studying the relations between the rust-fungi and certain insects which visit their spermogonia to feed upon the spermatia and a sugary excretion which is found with them. The fragrance of the spermogonia of a number of species — e.g., Puccinia suaveolens of the Canada thistle — has been noticed by everybody who has studied these fungi; and the brightly colored spots in which they occur is equally well known. What benefit the fungi derive from the visits of ants and other insects is still to be shown, and will probably remain a mystery until the true function of spermatia is understood; but there is some reason for believing that the color, fragrance, and sweet secretion of their spermogonia are designed, like the similar peculiarities of many phenogamic flowers, expressly to attract these visitors. — (*Denkschrift. wien. akad.*, xlvi.) W. T. [781

Phenogams.

Notes on Echinocactus. — Mr. Thomas Meehan announced the discovery of sensitive stamens in Echinocactus Whipplei. The motion of the stamens, when touched, was not instantaneous, several seconds

sometimes elapsing before the effect was observed. The flowers of this species are unable to expand to any great extent, on account of their short tube surrounded by strong and stiff spines. If the flowers could expand, as in Opuntia, and the stamens lie flat, as in that genus, the motion might be equal. As in Opuntia, the motion was not always up towards the pistil, but might be horizontal, to the left or to the right: there seemed to be no rule. The bending was from the base, as the filament retained a perfectly straight line during the movement. Mr. Meehan further remarked, that, in descriptions of cactaceous plants, the relative length of petals or stamens to the pistil was often given. He had observed, that in many species, near the period of the ejection of the pollen from the anther-cells, the stamens and style were of about equal length, but that the latter continued to grow after the maturity of the anthers, and, in Echinocactus Whipplei, would finally reach to near half an inch above. He had not been able to get any genera of Cactaceae to fruit under cultivation, except Opuntia, unless they were artificially pollenized. By the application of the flower's own pollen to the stigma, they usually perfected fruit. His specimens of Echinocactus Whipplei and E. polyancistrus had bright purple flowers, although the latter were usually described as yellow or greenish. — (*Acad. nat. sc. Philad.; meeting* April 10.) [782

The relations of heat to the sexes of flowers. — Mr. Thomas Meehan remarked that he had observed that a few comparatively warm days in winter or early spring would bring the male flowers of monoecious plants to maturity, while the female flowers remained to advance only under a higher and more constant temperature. He believed this accounted for their frequent barrenness. Last spring the male flowers of a specimen of Corylus avellana were past maturity before the appearance of action in the female flower-buds. There were consequently no nuts on this tree last season. The present season was one of unusually low temperature, and the hazel-nut had not had its male blossoms brought prematurely forward. The male flowers were showing their anthers, while the female buds had their pretty purple stigmas protruding. He could therefore predict with confidence a full crop from the tree which the season before was barren. — (*Acad. nat. sc. Philad.; meeting* April 10.) [783

(*Systematic.*)

Grasses. — Dr. Vasey proposes to publish, in connection with F. L. Scribner, a full catalogue of North-American grasses, and in a circular gives the names merely of twenty-nine new species and varieties, mainly based upon recent collections, but as yet unpublished. Mr. Scribner continues his list of the grasses of Pringle's collection in Arizona and California, giving descriptions of the less familiar species. He also describes a new Poa from the head waters of the Sacramento, and a viscid species of Diplachne from near Tucson; though of the latter he says, "It is not improbable that it has already been described in works not accessible." — (*Bull. Torr. bot. club*, March, 1883.) S. W. [784

New ferns. — Mr. Lemmon's researches in the Huachucha Mountains, near the boundary-line in Arizona, add several species to the list of United-States ferns. Prof. Eaton describes five such species, previously known only from Mexico or farther south, — a Polypodium, a Notholaena, a Pellaea, a Cheilanthes, and two Aspleniums. He adds a new Notholaena, from California and Arizona, hitherto confused with N. candida, and notes the discovery of Asplenium montanum in Connecticut. — (*Bull. Torr. bot. club*, March, 1883.) S. W. [785

Lythraceae. — Koehne concludes the strictly systematic portion of his monograph with the genus Lagerstroemia, of twenty-one species, chiefly of central Asia, China, and Japan (two native to Australia, and one in Madeira), and Lawsonia, of a single species, the 'Henna' of the orientals, widely cultivated in the tropics, but of uncertain origin. A discussion of the geographical distribution and of the morphology of the order is to follow. — (*Engler's bot. jahrb.*, March, 1883.) S. W. [786

ZOÖLOGY.

Protozoa.

Investigations on certain Protozoa. — Dr. August Gruber, the skilful observer of Protozoa, has published a memoir in which he describes two new salt-water rhizopods, and reports new observations on certain Infusoria, and the conjugation of Actinophrys. The first new rhizopod is named Pachymyxa hystrix. It is distinguished especially by an envelope composed of little rodlets, standing perpendicular to the surface. In this envelope are pores through which simple, not branching, lobate pseudopodia can be extended, as in a foraminifer. The animal can slowly alter its form. It is brown in color, and has in its interior numerous bodies which may be small nuclei. In the same aquarium a similar animal was observed, but which had no envelope. Gruber considers this second form as probably the same species in a different condition. The second new species, Amoeba obtecta, is very small (0.03–0.04 mm.). It builds itself a granular dome-shaped house. It has no contractile vacuole; but a nucleus may be brought out by reagents. As they move about little, they are usually found in colonies.

In part second (Infusoria) a new species (S. guttula) of Spongomonas is described. The minute round or oval flagellate animals live each in its tube; but the tubes are all united together to form a hollow sphere. Gruber suggests, that, as they occur in putrid water, they have gathered together around a bubble of oxygen, and so come to form a hollow colony. The genus Stichotricha is remarkable among hypotrichous Infusoria for forming a protective covering. Gruber describes several forms, which may be only varieties of S. socialis, besides another form, which he names S. urnula. It lives in a transparent, membranous, flask-shaped shell, has the characteristic ciliation of the genus, two oval nuclei, to be seen only in stained specimens, but no nucleoli were detected. Over the body are flexible cilia, capable of acting alternately as cilia and pseudopodia. The animals multiply by division; the two daughter-animals living a while in one shell, until one wanders forth, and forms a new shell, usually near by, so that a colony may be thus formed. Gruber also refers Kent's Chaetospira and Hudson's Archimedea to Stichotricha.

Besides the usual fusion of two or many individual Actinophrys, Gruber has observed the fusion as rather absorption of a small Actinophrys without a nucleus by a big nucleated individual. There is no reason for believing that either form of fusion is concerned with reproduction. Finally the author advances some general considerations to show that the nucleus has no importance for those functions of the cell-body which stand in no direct relation to reproduction; namely, movement, assimilation, excretion, and growth. It may also be without influence on the external form. — (*Zeitschr. wiss. zool.*, xxxviii. 45.) C. S. M. [787

Mollusks.

Large American pearls. — Some remarkably large pearls have been obtained, during the last fishing-season, at the fishery near La Paz, in the Gulf of California. One found in December, — the largest on record from this region, — weighing 75 carats, sold on the spot for $14,000, and is considered to be worth much more. Another very perfect one, of 47 carats, is valued at $5,000; and a third, at $3,000. It is many years since such good fortune has attended the divers of this region, though the product of pearls of moderate size has been tolerably constant. — (*Mex. financero*, Jan., 1883.) W. H. D. [788

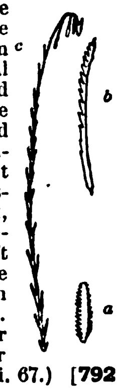
Ottawa Unionidae. — The researches of Mr. F. R. Latchford among the fresh-water mollusks of the vicinity of Ottawa have been fruitful of results. In 'Notes on Ottawa Unionidae,' he mentions fourteen species of the genus Unio, of which one (U. borealis Gray) is new, and apparently valid. There are also three species of Margaritana, and ten of Anodonta. Previously, only twelve species altogether had been recorded from this vicinity. The paper is full of interesting biographical details in regard to the species enumerated, and their varieties. The author notes the asymmetry of the embryos of Unio in Anodonta fluviatilis, Unio luteolus, and U. borealis, and infers it for Unionidae in general, though they have been described as perfectly symmetrical. A mite found in the gills of A. fragilis, and placed in the hands of Mr. Tyrrell for investigation, is as large as a pellet of buckshot. It appears that the lumbermen on the Chaudière eat these mollusks, and obtain them in an ingenious manner. Birch brushwood, tips down, is attached to the raft so as to drag gently over the bottom when in the shallows. The open bivalves feel the twigs passing over, close the valves on them, and hold fast. At intervals the brush is lifted, and the adhering 'clams' are picked off. — (*Trans. Ott. field nat. club*, no. 3.) W. H. D. [789

Fossils of the Rizzolo clays. — Seguenza has just issued a brochure in regard to the clay deposits of Rizzolo, province of Syracuse, Sicily, with lists of the fossil mollusks found in them, which comprise two pteropods, fifty-five gasteropods, and sixty-eight lamellibranchs, many of which still live in adjacent waters. The deposit is considered by the author to be quaternary, and derives its interest particularly from the fact, that remains of the living African elephant (E. africanus Blum.) have been discovered in it, raising interesting questions as to the former range of that mammal. To the discussion of this branch of the question, and of the identity of the species, the paper is chiefly devoted. — W. H. D. [790

Myriapods.

Devonian myriapods. — An interesting discovery has been made by B. N. Peach, in the lower old red sandstone of Scotland, of myriapods in rocks older than the carboniferous series, the lowest that have before this yielded them. Two species are described and excellently figured, one of which has long been known, and supposed to be a Crustacean, having been described by Page under the name of Kampecaris forfarensis. They are of small size, and differ considerably from each other. Kampecaris is cylindrical, scarcely tapers at the head end, and is composed of numerous sub-equal alternately larger and smaller somites, each bearing a pair of legs. Archidesmus is depressed, fusiform, with alternately very unequally larger and smaller somites, each bearing a pair of 'six or seven jointed' spinous legs (none are shown in the figures attached to the smaller, intercalary somites). It will be seen that they differ considerably from the known carboniferous myriapods. — (*Proc. roy. phys. soc. Edinb.*, vii. 177, pl.) [791

Dermal appendages of Polyxenus. — The different forms of hairs in P. fascicularis are described and figured by Scudder; those upon the body-joints, *a*, *b*, varying from club-shaped spines, furnished with several rows of flattened teeth, to sabre-shaped spines, serrate on the convex side. The posterior extremity of the body is provided with a pair of cylindrical fascicles, resembling those of the larva of Anthrenus, but composed of very curiously-formed bristles, *c*, shaped like an elongated fish-hook, the shaft gently curved, and the tip recurved and apically barbed. The shaft is armed with delicate spinules, and the crook furnished on the concave side with a few spatulate, drooping appendages. These appendages are also figured, rather rudely, by Packard in the *Amer. nat.* for March. — (*Proc. Bost. soc. nat. hist.*, xxii. 67.) [792



Insects.

The American species of swallow-tail butterflies. — As the result of the study of a large series of forms partly collected by himself in Washington Territory east of the Cascade Mountains, — a hitherto unexplored region, — Dr. Hagen concludes that P. Zolicaon, oregonius, and Aliaska, are all specifically inseparable from the old-world P. Machaon, the range of variation in which he also discusses. He also unites P. Rutulus and Eurymedon, and considers them a western form of P. Turnus. — (*Papilio*, ii. 149.) W. H. Edwards vigorously combats this view, so far as the first series is concerned (*Ibid.*, iii. 45, pl.). [793

Wisconsin Lepidoptera. — The geological survey publishes a catalogue of Wisconsin Lepidoptera by Hoy, long known as an enthusiastic collector in that state. The title is a misnomer; for, besides the butterflies (99 sp.) and hawk-moths (52 sp.), the author only enumerates the Bombycidae (75 sp.) and Geometridae (109 sp.); the Noctuidae (388 sp.) being oddly placed in a separate list, and other groups wholly omitted. Not the slightest notes are appended, except in the first two groups, where an indication of the abundance of the species, in a single word, is usually given. With the exception of an occasional straggler from the south, the list contains nothing noteworthy. — (*Rep. geol. surv. Wisc.*, i.) [794

Geographical origin of North-American Sphingidae. — Three proximate sources are found by Grote for our Sphingid fauna, which consists of about 93 species. Omitting Sphinx, which the author claims to belong to an older period of separation, 10 genera (32 sp.) are considered as descendants of a circumpolar pre-glacial fauna; 11 genera (26 sp.), accessions from the tropics; and 14 genera (20 sp.), of North-American origin peculiar to the continent. All the species of a genus (excl. Sphinx) are thus seen to have a common geographic origin. "The decisive element in our fauna does not come from the old world." — (*Amer. journ. sc.*, March.) [795

VERTEBRATES.

(Physiology.)

Influence of the centre of deglutition on that of respiration. — Steiner calls attention to some generally overlooked researches which show that an act of swallowing is usually accompanied by a more or less marked respiration, and himself adds

some new facts. He finds, that, on stimulation of the central end of the superior laryngeal nerve in the rabbit, every resulting swallowing movement is accompanied by more or less marked inspiration and expiration, and that the respiratory muscle concerned is the diaphragm. He concludes that the two centres are so united by commissural fibres that every stimulation of the deglutition centre is associated with excitation of the respiratory. — (*Du Bois' archiv*, 1883, 57.) H. N. M. [796

Digestion with exclusion of the stomach. — Working on dogs, Ogata finds, that when food is directly placed in the duodenum, and all gastric (also salivary) secretion is kept out of the intestines, the animal can still digest many things well, so as to maintain its weight, and pass normal faeces. Certain foods, however (as connective tissue), need the preparatory action of the gastric acid in order that they may undergo normal digestion; others need a change in their surface, or decomposition into small fragments such as usually occurs in the stomach, in order that they may lie long enough in the intestine to be thoroughly dissolved. The stomach, therefore, gives the dog opportunity to use a wider range of substances for the satisfaction of its nutritive wants. The transformation of proteids into urea occurs more uniformly when the stomach is allowed to act. — (*Du Bois' archiv*, 1883, 89.) H. N. M. [797

Influence of carbon-monoxide poisoning on trypsin. — Podolinski has found that the transformation of pancreatic trypsogen into trypsin is associated with the assumption of oxygen. Herzen finds that the pancreatic infusion of dogs killed by carbon-monoxide gas, which infusion, under normal circumstances, would have contained much trypsin, possesses hardly any. He concludes that either the absence of oxygen from the blood has led to a reconversion of trypsin into trypsogen, or that trypsin forms with carbon monoxide a compound which is not proteolytic. — (*Pflüg. archiv*, xxx. 308.) H. N. M. [798

Reptiles.

The physiological action of Heloderma poison. — That this lizard, the Gila monster (Heloderma suspectum), is venomous, has been often asserted and as often denied. Weir Mitchell and Reichert find that its mouth-liquids are highly poisonous, killing frogs, pigeons, and rabbits in a few minutes. This establishes it as the only venomous lizard known. What is of even more interest, perhaps, is the fact that the physiological action of the poison is quite different from that of snake-poison: the latter kills essentially by paralyzing the respiratory centre, the former by paralyzing the heart. Heloderma venom causes no local injury when injected subcutaneously; and arrests the heart in diastole, from which condition the organ slowly passes into a contracted state. The heart-muscle entirely loses its irritability when the organ ceases to beat, and when other muscles and the nerves still readily respond to stimulation. The spinal cord is paralyzed. — (*Medical news*, Feb. 10.) H. N. M. [799

Relations of the Mosasauridae. — M. Dollo, assistant naturalist to the royal natural history museum of Brussels, separates the Mosasaurus Maximiliani of Goldfuss generically from the M. Camperi, under the designation Pterycollasaurus. In this new genus the pterygoids are united along two-thirds of their entire length, especially in the dentary portion, whereas in the typical Mosasaurus they are entirely separate. This last is also the case with the American genera Tylosaurus, Lestosaurus, Holosaurus. In another new genus now indicated, Plioplatecarpus (P. Marshii), which appears to be closely related to Leiodon and Lestosaurus, and of which fragments are contained in the museum of Brussels, the author indicates the presence of a sacrum composed of two united vertebrae having the same disposition as the similar parts in the pelvic girdle in the iguana and monitor. From the presence of this sacrum, M. Dollo concludes, in opposition to the views of Prof. Cope (who, under the name of the Pythonomorpha, approximates these animals to the serpents), that the mosasauroids were true lacertilians, and that they held a place among these similar to that occupied by the pinnipeds among the carnivora. — (*Bull. mus. royal Belg.*, i. 55.) A. H. [800

Mammals.

The bunotherian mammals. — Professor E. D. Cope defines the Bunotheria as resembling in most technical characters the Edentata and the Rodentia. Their enamel-covered teeth, however, separate them from the former, while the articulation of the lower jaw is different from that found in the latter. This is a transverse ginglymus with a posterior process in the Bunotheria, as distinguished from the longitudinal groove permitting antero-posterior motion of the Rodentia.

After dwelling on the characters of the related forms, and pointing out the inconsistencies of the present classification, he defined the five suborders as follows: —

I. Incisor teeth growing from persistent pulps.
  Canines also growing from long persistent pulps, agreeing with external incisors in having molariform crowns . . . . I. Taeniodonta.
  Canines rudimental or wanting; hallux not opposable. . . . . II. Tillodonta.
  Canines none; hallux opposable. III. Daubentonioidea.
II. Incisors not growing from persistent pulps.
  Superior true molars quadrituberculate; hallux opposable . . . . IV. Prosimiae.
  Superior true molars quadrituberculate; hallux not opposable . . . . V. Insectivora.
  Superior true molars trituberculate; hallux not opposable . . . . VI. Creodonta.

It was possible that the group which he had called the Mesodonta may yet be distinguished from the Insectivora by characters now unknown. But he could not admit any affinity between this group and any form of pachyderms, as suggested by Filhol, or of Suillines as believed by Lyddeker, as such suppositions are directly opposed to what we know of the phylogeny of the mammalia. These views are apparently suggested by the bunodont type of teeth found in various Mesodonta; but that character gives little ground for systematic determination among Eocene mammalia, and has deceived paleontologists from the days of Cuvier to the present time. The only connecting-point where there may be a doubt as to the ungulate or unguiculate type of a mammal is the family Periptychidae of the suborder Condylarthra. The suborder Hyracoidea may furnish another index of convergence.

He had at one time called this order by the name Insectivora, a course which some zoölogists may prefer. A name, however, should as nearly as possible adhere to a group to which it was first applied, and whose definition has become currently associated with it. Such an application is a material aid to the memory. There are various precedents for the adoption of a new general term for a group composed of subordinate divisions which have themselves already received names. — (*Acad. nat. sc. Philad.*; *meeting* April 3.) [801

ANTHROPOLOGY.

Are the stone graves modern? — Throughout Kentucky, Tennessee, and other sections draining into the Ohio, the aborigines, at some former period, buried their dead in stone boxes or cists, made of thin slabs of limestone, and other rock. There are those who maintain that this form of burial was practised by a highly cultured race of people, who passed away before our modern Indians set foot in that country. Dr. Charles Rau, in a paper before the American association at Montreal, gave an account of graves opened by Dr. Wislizenus, in Randolph County, Ill., containing both of Dr. Morton's types of North-Americans, — the Toltecan, and the true American. Dr. H. Shoemaker opened a stone grave, in Monroe County, Ill., which contained the remains of a Kickapoo Indian. Dr. Rau concludes that the stone graves owe their origin to the race inhabiting within historic times, or even earlier, the district where they are found. — (*Amer. nat.*, Feb.) J. W. P. [802

Cup-shaped sculpture. — One of the enigmas of the stone age is the occurrence of cup-shaped cuttings, singly or in groups, from the size of a half-bullet upwards, upon small, movable bowlders, as well as upon large stationary rocks. Dr. Rau, in his paper on "Cup-shaped and other lapidarian sculpture in the old world and in America," has ransacked the literature of Great Britain, France, Switzerland, Germany, Scandinavia, and India, for old-world examples. Many of these are very elaborately carved and encircled, giving evidence of connection with ancient mystic rites. The American specimens are much ruder; and the cautious author is disinclined to attribute to them the same mystery that hangs over those in the eastern world. — (*Contr. N. A. ethnol.*, v.) O. T. M. [803

EGYPTOLOGY.

The Fayoum. — The good work done by Mr. Cope Whitehouse (*Rev. archéol.*, Juin, 1882; *Bull. Amer. geogr. soc.*, 1882, No. 2) on the boundaries of the ancient Lake Moeris is to be supplemented by further researches into the formation of the pyramids, and the possibilities of irrigation in the Fayoum. Mr. Whitehouse is now in Cairo; and, with the aid of government surveyors, he hopes to verify his theories, which have been somewhat misunderstood. — (*Athenaeum*, March 24.) H. O. [804

Ancient Egyptian economy. — Broken crockery was not entirely lost to the Egyptian, for he saved the pieces to have inscribed on them the tax-gatherer's receipts. Immense numbers of these inscribed fragments have been found; and, from the collection in the British museum, Dr. Birch has given a series of translations, showing the tax in Egypt under the early Caesars. — (*Proc. soc. bibl. arch.*, March 6.) H. O. [805

New discoveries. — This year promises large results in new discoveries. The director of the Boolak museum, Maspero, though with scanty means, has made great progress in new work. He has obtained a royal sarcophagus of the twenty-fifth dynasty, and several valuable mummies. He has also found an Egyptian crypt containing an early Coptic church, with all its ecclesiastical furniture intact. — (*Academy*, March 24.) H. O. [806

Work in progress. — The mural decorations of the tomb of Seti I. (Belzoni's tomb) at Bab-el-Molook are now being copied by Lefébure, Loret, and Bourgoin, members of the French college of archeology at Cairo. The temple of Luxor is to be excavated in the autumn. Maspero is to resume the excavation of the pyramid at Lisht in May. — (*Academy*, March 24.) H. O. [807

EARLY INSTITUTIONS.

Manumissions at four roads. — F. E. Warren finds proof, in the Leofric missal, — a X.-XI. cent. MS. preserved at the Bodleian in Oxford, — of the existence, in England, of the custom of manumitting slaves at places where four roads meet (*on feower wegas*). The passage is given in full from the MS. — (*Rev. celt.*, Jan., 1882. Cf. *Rep. Devonsh. ass. adv. sc.*, viii. 417, 1876.) D. W. R. [808

Ostracism. — M. Houssaye gives a brief history of ostracism as it obtained in Athens and other Greek cities and colonies, *à propos* of the effort to introduce something like it in France. — (*Rev. deux mondes*, 15 Fév.) D. W. R. [809

Moslem property-law. — Baron von Tornauw writes at length upon this subject. It has been generally maintained, in regard to the land in Moslem countries, that it has been the common property of the people (*der moslemischen religionsgenossenschaft*); that the individual has had no real right of property in it, only a usufruct (*nutzungsrecht*). The writer attempts to show, that according to the Koran, according to tradition, and according to the law-books (*scheriëtbüchern*), private property in land, in the fullest sense of the term (*volles eisenthumsrecht auf grund und boden*), existed everywhere. The writer gives a list of sources (34 titles). — (*Zeitschr. deutsch. morgenl. gesellsch.*, xxxvi. ii.) D. W. R. [810

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody museum of American archaeology, Cambridge, Mass.

The ancient cemetery at Madisonville, O. — In his recent explorations in connection with Dr. G. L. Metz, Mr. Putnam made extensive researches at this place. Near the cemetery are several earth-circles, from forty-three to fifty-eight feet in diameter. Trenches run through four of them revealed in the centre of two, on the clay bottom, beds of ashes in which were potsherds, flint-flakes, and burnt bones, with a perforated clam-shell. In the trench, on the clay, there were found a rudely chipped stone hoe, a rude stone axe with a groove, a split pebble, a fragment of a stone gorget, worked antler-tips, and several rude arrow-points. The results of the examination of these circles proved them to be the sites of habitations, over which from one to two feet of leaf-mould has formed since the central fires were deserted and the circular structures fell from decay. The few things found within the circles, and the abundance of household utensils, implements, and refuse, found in the ash-pits, suggest the possibility, that on special occasions all the articles in the house, with ornaments, implements, and other personal objects, were partly destroyed by fire, and the remnants, being gathered up with the ashes, were deposited in a pit dug for the purpose; while the great number of broken bones of various animals, mixed with the ashes, indicates that at such times feasts were held. Such a custom would

account for the character of the contents of the pits, and the great number of the pits would indicate a long-continued occupation of the village.

Houghton Farm, Mountainville, N.Y.

Soil-temperatures. — During the past year observations upon soil-temperature were carried on by means of mercurial thermometers of special form, adjusted to slow action. It was sought, however, to overcome the inconveniences of their use, since they require to be drawn at each reading. Recourse was therefore had to an electrical thermometer, which is now in use, supplementary to, and in extension of, the mercurial thermometers, which will continue to be employed. The thermo-apparatus is really one of Becquerel's electrical thermometers, though some slight modifications have been introduced in the method of balancing the current. The apparatus, as now in use, may be described as follows: —

Couples are formed by soldering copper wires to the iron line-wire at such intervals as are required. These are then enclosed in an hermetically-sealed tube, filled with perfectly dry sand, free from iron, and brought to a common level above ground, where they are firmly connected with binding-screws. The cap carrying the binding-screws is of wood, three inches greater in diameter than the tube, and painted white to prevent any possibility of radiation from the latter. The tube is then planted in the soil, wherever needed, at the required depth, and such connection made with the office as may be desired. A duplicate set of couples, exactly like those in the tube, is provided in case a test is necessary. The wires are of the same size all the way through, and are No. 8 copper, insulated, and No. 8 telegraph wire. In the office a second couple of the copper and iron wires is carried down into a well of wood, having a diameter of one inch and a quarter inside, with walls of two inches thickness. This is provided with a stop-cock and overflow attachment. From a convenient support, immediately above the mouth of the well, depend a thermometer, the bulb of which is brought to the same level with the couple, and two glass tubes, which supply hot and cold water from reservoirs placed upon a shelf at convenient distance. A switch-board is introduced into the line of copper wire, while a very sensitive galvanometer is introduced into the line of iron wire. A deflection of the galvanometer-needle to the right or left is neutralized by balancing the current with the hot or cold water, as the case may require, and readings taken when the needle comes to zero. I believe this is the first attempt in this country to apply this apparatus to so extended use.

So far as observations have gone, the advantages which this instrument possesses over mercurial thermometers seem to be: 1. Greater accuracy; 2. Expedition; 3. Greater durability; 4. Personal comfort, and absence of those annoyances inseparably connected with an instrument which must be drawn from the ground in all kinds of weather, and at all times of day and night.

NOTES AND NEWS.

Since the leading article of this issue was ready for the press, the circular issued by the council of the British association to its members has come to hand; and from this it would appear that the meeting in Montreal is regarded as substantially determined on, and that the time fixed for it will probably be the last week of August, or the first week of September, 1884.

— The director of the Illinois state laboratory of natural history, Dr. S. A. Forbes, to whose office that of the state entomologist was recently attached, has made a special report to the state board of education, in which he states that the field-work of the botanical and zoölogical survey of Illinois is substantially done, and recommends the immediate preparation and publication of systematic reports on the natural history of the state, having special reference to economic ends. He estimates four volumes as necessary to cover the zoölogy (exclusive of injurious insects) and cryptogamic botany. No additional appropriations appear to be asked for, but rather the diversion of the ordinary funds from field-work to publication. The board of education, which controls the laboratory in Illinois, was so appreciative of the excellent work which Dr. Forbes has been doing as to vote him $500 more than he asked. We wish Dr. Forbes success in his new departure, and shall anticipate volumes of unusual interest.

— Professor Weyenberg of Cordoba, who has written upon many branches of zoölogy since he has been in the Argentine Republic, is now engaged, also, in publishing a manual of histology in Spanish, under the title 'Principios histologicos.'

— Mr. Dörfluger, of the Milwaukee natural history society, has recently made a minute examination of the methods of installation and details of administration in the National museum, with a view of introducing the best features into the new museum to be established by the city of Milwaukee, upon the basis of the collections of the society. Mr. Dörfluger will visit the natural history museums in the larger eastern cities before returning to the west.

— Major-Gen. Pitt-Rivers, of the English army, has spent the most of his leisure in collecting the most valuable anthropological museum in the world, from one point of view. Discarding areas, races, and epochs, his aim has been to collect from all parts of the world the products and implements of human industry in such numbers and variety as to illustrate the evolution of art. Having offered this splendid collection to the university of Oxford on condition that they would erect a building adequate to contain and to display it properly, Gen. Pitt-Rivers has the satisfaction of knowing that the university authorities will comply with his request. The delegates of the museum have elected Dr. E. B. Tylor to be keeper of the collection.

— Under the title "Mittheilungen über die arbeiten der moor-versuchs-station in Bremen in den jahren 1877-1882 (von Dr. M. Fleischer)," the last number of the Landwirthschaftliche jahrbücher (xii., no. 1/2) contains an account of the founding of this station, which is devoted to the investigation of questions connected with the reclamation and cultivation

of the extensive moors of north-western Germany, and a summary of its work up to the present time. This is followed by five papers, in which some of its investigations are recounted in detail. The subjects of these papers are: a geographical description of the moors of north-western Germany and the Netherlands (by Lalfeld), the Kehdinger moor (by Virchow), the behavior of insoluble phosphates in moor-soils (by Fleischer), the influence of certain salts on the action of peat upon phosphates (by Kissling), materials for manuring and improving moors (by Fleischer). This is the first detailed account of the work of the station which has appeared.

— The *Franklin democrat* of Brookville, Ind., prints, March 1, an account of the work of the Brookville society of natural history for the year ending February, 1883, by the secretary, Amos W. Butler. The active members increased in that period from fifteen to twenty-six.

— The building of the ice-palace at Montreal this winter has recalled to notice (*Symon's monthly meteorological journal*, February) an account, by Prof. G. W. Kraft, of that built at St. Petersburg in 1740. The most remarkable part of Professor Kraft's statement is, that an ice-cannon was made, and that a bullet fired from it, with a charge of a quarter of a pound of powder, penetrated a plank two inches thick at a distance of fifty paces.

— An excellent *résumé* of the present condition of our knowledge of fossil insects, extending over more than thirty pages, is given by Charles Maurice in the Annales of the *Société géologique du Nord.*, vol. ix.

— The *Amateur naturalist* is the title of a miniature paper of four pages, published monthly at Germantown, Philadelphia, entirely by boys. Its fifth and sixth numbers contain a brief abstract of a lecture on the cobblestone, given by Dr. H. Carvill Lewis before the Leidy association on Dec. 6.

— Mr. J. H. Barth of Leipzig will issue an "*Internationale zeitschrift für allgemeine sprachwissenschaft*" in semi-annual parts, under the editorial care of F. Techmer. The staff includes such names as Lucien Adam, C. von der Gabelentz, A. S. Gatschet, R. Lepsius, F. A. March, Frederick Müller, Max Müller, G. Oppert, F. Pott, Leon de Rosny, A. H. Sayce, H. Steinthal, Jules Vinson, and William Dwight Whitney. The review is to be organ of no school, but will aim to foster real progress in every line of linguistic research. The subject will be presented in three aspects, — the anthropological, the psychological, and the historical. Under the first the whole range of ancillary sciences will be brought under contribution; such as the physiology and pathology of the vocal organs and the ear; the optical phenomena of writing, mimicry, gestures, and writing for the blind; and the relationship existing between speech and its transcription. Upon the psychological side will fall all questions of the relation of articulation, vocal sounds, roots, words, and syntax, to the science of mind. Finally, the history of philology will include both the phylogenetic development of language as a whole, and the ontological development of speech in each individual from infancy to maturity. If the weight of great names and a great undertaking will insure success, no doubt the Zeitschrift will become a permanent part of our linguistic literature.

— At a recent meeting of the Philadelphia academy of natural sciences, Prof. H. C. Lewis showed a supposed stone implement recently dug up in that city. It is described as an oblong rectangle in shape, sixteen and a half inches long, nearly four inches wide, and in thickness varying from a half-inch at the edge to one and a half inches at the centre. It is ground to a smooth cutting-edge at the two extremities. It is rectangular in section, the sides forming right angles with the faces. The sides are parallel with each other; but the faces are undulating surfaces, on one of which is a prominent longitudinal ridge an inch and a half in width. Each end of the implement appears to have been smoothly ground to form a square, even cutting-edge, an equal amount of grinding having been done on either side. The implement is as unusual in shape as it is in size. It is double the length of ordinary celts, and was possibly a lapstone of some kind. The implement, if such it should prove, would be the first that has been found in the Philadelphia gravel, and would be of great interest in its bearing upon the antiquity of man on the Delaware.

— Dr. D. W. Prentiss has been invited to deliver a course of lectures in connection with the department of materia medica of the National museum. The course will consist of eight lectures, and will be illustrated by specimens and other material from the collections.

— At a meeting of the Society of arts of the Massachusetts institute of technology, April 12, Mr. A. F. Hill presented a paper on the Crystallization of iron and steel, illustrated by specimens and photographs.

— At the meeting of the Biological society of Washington, April 13, the following communications were made: Prof. L. F. Ward, Hybrid oaks of the District of Columbia; Mr. B. F. Johnson, Observations on the climbing of snakes; Prof. C. V. Riley, Remarks on the bag-worm (Thyridopteryx ephemeraeformis); Mr. F. W. True, The tape-worm and other parasites in the eggs of the domestic fowl; Dr. Thomas Taylor, Living parasitic mites in the lungs, cavities, and tissue of domestic fowl; Mr. N. P. Scudder, The muskrat (Fiber zibethicus) in captivity.

— Prof. A. Hall, on taking the chair of the mathematical section of the Washington philosophical society, April 11, read a short address on the practical value of the higher mathematics. Mr. C. H. Kum-

mell gave an investigation of "Alignment curves on any surface, with special application to the ellipsoid."

— Mr. A. W. Cramer reports the capture of two specimens of Catocala unijuga Walk., last autumn, in mid-ocean off the coast of Newfoundland, on board a steamer bound for Europe.

— Prof. G. F. Wright, in the *Cleveland leader* of April 9, gives an account of his successful search for the continuation of the great terminal moraine across the Ohio River in Kentucky. The marks of glaciation disappeared suddenly, "almost exactly upon the line between Campbell and Pendleton counties."

— Prof. H. Carvill Lewis has reprinted his lecture before the Franklin institute on The great ice age in Pennsylvania, with a shaded map indicating the southern limit of the glaciated area from the Atlantic to the eastern border of Ohio.

— At the recent yearly meeting of the Brookville (Ind.) society of natural history, the following officers were elected: Rev. D. R. Moore, president; D. W. McKee, vice-president; Amos W. Butler, secretary; Edgar R. Quick, corresponding secretary.

— G. Pouchet of the Museum of natural history of Paris is soon to visit the Azores on a scientific excursion. The municipal council of Paris has voted eight thousand francs towards his expenses.

— P. Sacconi has established his station at Harrar, Somali-land, and has despatched two caravans to the coast. The town is a miserable place, and hyenas prowl about its streets at night. Sacconi plans to go on to the unvisited district of the Ogadin Somali.

— Consul O'Neill has received a grant from the Royal geographical society to aid his explorations from Mozambique toward the snowy mountains, reported on his last expedition. He will go up the Shire River, and return overland north-eastward to the coast.

— The Bengal administration report for 1881–82 states that the Calcutta zoölogical gardens are in a very flourishing condition. Two new buildings have been constructed through the generosity of Messrs. Ezra and Gubhoy, citizens of Calcutta. The number of visitors for the year was 120,749, being an average of 331 daily. The gardens are open upon Sunday.

— M. Fau intends soon to set out from Wargla, Algeria, for the Tuareg country, Hausa, and Timbuctu, following the line of Flatters's disastrous expedition.

— According to recent calculations by A. J. Skene, surveyor-general of Victoria, the area of Australia, as closely as it can now be determined, is 2,944,019 □ miles. This is nearly 30,000 less than the previous official estimates. The population according to the census of 1881 was 2,144,550, — an increase of 36.92 % in ten years.

— The name of Buckland revives the days of childhood and geology, as a chiming bell in a foreign land recalls to the traveller memories of home. The U. S. bureau of ethnology has received from Miss A. W. Buckland a bound volume containing her collected essays upon various subjects relating to the natural history of man, embracing: The first metallurgists (1875); The origin and development of man (1875); Early phases of civilization (1876); Primitive agriculture (1877); Stimulants among savages and among the ancients (1879); Mythological birds (1879); Cornish and prehistoric Irish monuments (1879); Rhabdomancy and belomancy (1879); Surgery and superstition in neolithic times (1881); Our anthropological museum (1877). Other essays are bound in the volume, but they are not purely anthropological.

— Dr. Koner's list of publications of all kinds referring to geography for the year ending November, 1882, fills one hundred and forty-four pages in the recent number of the *Zeitschr. f. erdkunde* of Berlin. Of these, the United States require only five; while Africa has eighteen, Asia twenty, and Europe thirty-five.

— At a recent meeting of the Northumberland and Durham medical society, several forms of electric-light apparatus, devised by Mr. J. B. Payne for the illumination of internal cavities, were shown. A Swan lamp not larger than a bean is used. A battery of two or three Grove cells is sufficient to render the carbon filament incandescent.

— Prof. H. W. Wiley, former occupant of the chair of chemistry in Purdue university, Lafayette, Ind., has just been appointed (April 9) to the position of chief chemist of the U. S. department of agriculture. Professor Wiley is a native of Indiana, and a graduate of Harvard. His standing as a chemist is high among scientific men; and his paper on the relation of science to the industries and arts, read last January at one of the conventions held in the department building, attracted much deserved attention. Mr. Collier, whom he supersedes, was also an excellent chemist; and his abrupt dismissal by the commissioner of agriculture, after five years of service, and without justifiable reason as far as we can learn, merits the severest condemnation.

— The second biennial report of the director of the North-Carolina agricultural experiment station contains an outline of the work performed at the station during 1881 and 1882, a plan and description of the new apartments recently occupied by it in the building of the department of agriculture at Raleigh, a statement of some changes in the law establishing the station, and some account of the growth and present extent of the fertilizer-trade in the state.

The station has also published, in the form of bulletins, some analyses and investigations of horn, leather, and wool-waste, and the fertilizers containing them; of finely-ground phosphates, or 'floats;' and of kainite; as well as a list of analyses and valuations of all fertilizers examined up to March 1, 1883.

The finely-ground phosphates are the product of the Duc mill, working chiefly on South Carolina phos-

phates. The size of their particles was measured microscopically; and they were also treated with neutral ammonium-citrate solution, in the manner customary in fertilizer analyses. From fifteen to twenty-five per cent of the total phosphoric acid proved to be soluble in this reagent, but no very marked increase of solubility was observed as the result of very fine grinding.

The bulletin on kainite consists chiefly of a summary of German and American experience in its use, going to show, that, with even moderate caution, it may be used with as much safety and advantage as the refined potash salts now so largely employed.

— The last of the Washington free scientific lectures was delivered by Dr. Robert Fletcher on March 31. The weather being unusually bad, the audience was small. As a whole, the lectures have been remarkably well attended; and the interest displayed will doubtless encourage the societies to undertake another course next year. It is a prevailing opinion, that groups of three or four lectures upon the same subject, delivered in the evening, would meet the needs of the people better than the schedules hitherto provided.

— A new magnetic and meteorological observatory is soon to be established at Hong Kong: and Dr. W. Doberck goes from Col. Cooper's observatory, Markru, Ireland, as its director.

— Among the good works performed by the Musée Guimet appears the *Revue de l'histoire des religions*, published under the direction of M. Maurice Vernes, aided by distinguished collaborators in various countries. The journal has reached its sixth volume, and shows no signs of decay. The last number received contains papers on the following subjects: Islamism as a universal religion, by A. Kuenen; Aeneas before the time of Virgil, by J. A. Hild; The religions of non-civilized peoples, by A. Reville; The legend of Alexander among the Mussulmans, by M. Decourdemanche; and A course of instruction in the history of religion, by Paul Bert.

— Henry Y. L. Brown of Sydney, Cape Breton, has been appointed director of the geological survey of South Australia. Mr. Brown has a long acquaintance with the geology of Australia, having already been government geologist of western Australia, and assistant on the geological survey of Victoria and New South Wales. Besides, he was assistant of Mr. Selwyn in the geological survey of Canada during the years 1874–75.

— We regret to learn the death of George W. Stow, director of the geological survey of the Orange Free State, South Africa. Mr. Stow died at the end of last year, at a coal-mine near Heilbron, where he had discovered an important coal-basin. Heilbron is near Smithfield, Orange River. No one has done so much towards elucidating the geology of southern Africa as Mr. Stow. His 'Geological notes upon Griqualand West,' and his 'Coal and iron in South Africa' are both standard works.

— The third German geographers' congress, assembled at Frankfurt-a.-M. from March 29 to April 8, listened to addresses by Wissmann, on his journey across Africa; Ratzel, on polar exploration; Buchner, on the ethnography of south-western Africa; Pechuël-Lösche, on the lower course of the Kongo; Günther, on the latest studies of the earth's form; Toula, on the geological exploration of the Balkan peninsula; and Penck, on the influence of climate on the form of the earth's surface; besides several others, chiefly devoted to methods of geographic instruction. In connection with the meeting, there was a geographic exhibition, of which the catalogue contains 1,100 numbers, and fills 92 pages. Different styles of mapping were very fully illustrated; and there was a good representation of atlases, globes, wall-charts, and geographic works.

— Dr. B. A. Gould of Cordoba, Argentine Republic, now on a visit to this country, exhibited to the Royal astronomical society, March 9, a number of photographs of star-clusters in the southern heavens. There were, beside these clusters, four stars suspected to have an appreciable annual parallax. Dr. Gould stated that the observations for his zone-catalogue (105,000 in number) were completed in 1875; but the subsequent reductions had given a great deal of trouble, as his staff was limited, and he had been obliged to enlist into the service everybody he could find who had had sufficient education to be of use. "I have had bakers, shoemakers, printers, carpenters, bricklayers, and school-masters, sailors and engine-drivers. Of course, the degree of accuracy was sometimes questionable, and I have been obliged to do every thing in duplicate." Dr. Gould hopes that in a year's time the zone-catalogue, in two volumes, with 74,600 stars, will be published. The zones extend only from the tropic to within ten degrees of the south pole. Dr. Gould is also engaged upon a general catalogue of about 34,000 stars, their positions being determined with the highest degree of accuracy. This catalogue includes every part of the southern hemisphere; and the work is so far advanced that eighteen months more will suffice to complete it.

— An examination of the Waterville meteorite of 1826 shows, according to Dr. M. E. Wadsworth, that it is a slag that had long lain partly buried in sandy soil, and could not have been, as claimed, a freshly detached meteorite.

— The philosophical society of Washington, at its meeting held April 21, was addressed by Capt. William H. Dall, on Glaciation in Alaska, and by Professor Franklin B. Hough, on the Cultivation of the Eucalyptus on the Roman campagna.

— We are glad to announce that the United States is at last represented in the international zoölogical station at Naples. Thanks to the liberality and

wisdom of President Carter and the board of trustees, Williams College has secured from Dr. Anton Döhrn the right to a table in the Naples station. It is intended to make this in reality an American table; it being open to any original worker from the United States who has received his appointment from the authorities of Williams College. The only agreement necessary in connection with an appointment is, that the appointee, on his return to America, deliver a brief course of lectures at Williams, by which the college may gain some of the advantages which have been afforded the appointee at Naples. The name of each naturalist who lectures at the college will appear in the catalogue as lecturer on the staff of instruction.

Dr. Edmund B. Wilson, Fellow by courtesy of the Johns Hopkins University, is the first and present appointee to the position.

—Mr. Common of Ealing, Eng., presented to the Royal astronomical society, at its meeting March 9, a Woodburytype enlargement of a photograph of the nebula of Orion, taken Jan. 30, 1883, with his great three-foot reflector, the exposure being thirty-seven minutes long. He considered that it showed a marked advance on previous photographs. Some of the finer details were lost in the enlargement, yet this showed several features not rendered in any drawing. Mr. Common called attention to several differences between the photographs and the drawings of Lord Rosse.

RECENT BOOKS AND PAMPHLETS.

Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.

Babut du Mares. Le sewage, son utilisation et son épuration. Bruxelles, *Office de Publicité*, 1883. 260 p., 1 pl. 8°.

Balfour, F. M. Traité d'embryologie et d'organogénie comparées. Traduit par H. A. Robin. T. I.: Histoire de l'oeuf; embryologie des invertébrés. Paris, *Baillière*, 1883. 23+567 p., illustr. 8°.

Barratt, A. Physical metempiric. London, *Williams*, 1883. 8°.

Bertillon, A. Ethnographie moderne. Paris, *Masson*, 1883. 8+312 p., illustr. 8°.

Burnham, S. M. History and uses of limestones and marbles; with 48 chromo-lithograph illustrations of antique and modern marbles. Boston, *S. E. Cassino & Co.*, 1883. 410 p. 8°.

Clark, John S. Industrial education a necessary part of public education. (A paper read before the American institute of instruction, Saratoga, July 13, 1882.) Boston, *The Prang educational company*, 1883. 47 p. 8°.

Czyszkowski, S. Exploration géologique et industrielle des régions ferrifères de l'île d'Elbe. Alais, *imp. Martin*, 1882. 87 p. 8°.

Delboeuf, J. Questions de philosophie et de science. Éléments de psychophysique générale speciale. Liége, *Desoer*, 1883. 256 p. 12°.

Detmer, W. Lehrbuch der pflanzen-physiologie. Breslau, 1883. 400 p. 8°.

Dewar, D. Weather forecasts, air and tidal currents, and dates of storms for 1883. London, 1883. 8°.

Engelmann, Th. W. The physiology of protoplasmic motion. Translated by Charles S. Dolley. Rochester, *Davis & Leyden*, n.d. 40 p. 8°.

Ennis, Jacob. Two great works to be done on our sidereal system. Washington, *Judd & Detweiler*, 1883. 12 p. 8°.

Gestro, R. Manuale del preparatore ed imbalsamatore. Milano, 1883. 118 p. 16°.

Hauck, W. Ph. Die galvanischen batterien mit besonderer rücksicht auf ihre construction u. ihre mannigfaltigen anwendungen in der praxis. Wien, 1883. 256 p., illustr. 8°.

Heidorn, D. Karte der im mittleren Europa mit blossen augen sichtbaren sterne, auf das mittl. aequ. 1870 berechnet. Göttingen, 1883. f°.

Hutton, F. W. Catalogue of the New Zealand Diptera, Orthoptera, Hymenoptera; w. descriptions of the species. New Zealand, *Wellington*, 1881. 132 p. 8°.

Kroman, K. Vor naturerkjendelse. Bidrag til en mathematikens og fysikens theori. Kjoebenhavn, 1883. 516 p. 8°.

Leconte, J. L., and **Horn,** G. H. Classification of the Coleoptera of North America. Washington, *Smithsonian institution*, 1883. (Smithsonian misc. coll.) 38+567 p. 8°.

Ledger, E. The Sun; its planets and their satellites. New York, 1883. 12°.

Lefebvre, B. Les passages de Venus sur le disque solaire. Étude historique suivie d'un appendice sur les observations du 6 decembre, 1882, et du récit des expéditions belges. Louvain, *Peeters*, 1883. 70 p. 8°.

Lelontre, G. Recherches expérimentales et analytiques sur les machines à vapeur. Détermination de l'eau entrainée par une méthode thermométrique. Nancy, *Berger-Levrault*, 1883. 63 p. 8°.

Malapert, E. Notes sur le magnétisme et sur la compensation des compos. Nancy, *Berger-Levrault*, 1883. 70 p. 8°.

Mawley, E. The weather of 1882 as observed in the neighborhood of London, and compared in all respects with that of an average year. London, *Stanford*, 1883. 75 p. 8°.

Morgan, C. L. Water: its teachings in chemistry, physics and physiography. London, *Stanford*, 1883. 12°.

Perre de Roo, La, V. Monographie des pigeons domestiques. Paris, 1883. 394 p., illustr. 8°.

Perrier, E. Éléments de zoologie pour la classe de cinquième. Paris, *Hachette*, 1883. 12+497 p., illustr. 12°.

Peters, C. H. F. Celestial charts made at the Litchfield observatory of Hamilton college. Nos. 1-20. Clinton, 1883. Imp. f°.

Renault, B. Cours de botanique fossile fait au Muséum d'histoire naturelle. 3 ann. Paris, *Masson*, 1883. 322 p., 36 pl. 8°.

Reuter, O. M. Finlands och den Skandinaviska halföns Hemiptera Heteroptera. Stockholm, 1882. 8°.

Scheube, B. Die Ainos. Yokohama, 1883. 32 p., illustr. f°.

Schwackhöfer, F. Technologie der wärme u. des wassers mit besonderer berücksichtigung des dampf kesselbetriebes. Wien, 1883. Illustr. 8°.

Sedgwick, W. Light the dominant force of the universe: showing by means of experiments, what light is, what electricity is, and what life is; also, how to reconcile religion and science. London, 1883. 298 p. 8°.

Sicard, H. Éléments de zoologie. Paris, *Baillière*, 1883. 16+842 p., illustr. 8°.

Stoddard, John T. An outline of qualitative analysis for beginners. Northampton, *Gazette printing-office*, 1883. 4+54 p. 16°.

Thomas, Albert. Manuel de l'alcoométrie. Tables et formules pour servir au calcul des mélanges d'eaux-de-vie à tous les degrés. Lille, *Michelet*, 1882. 8°.

United States coast and geodetic survey. A treatise on projections by Thomas Craig. Washington, *Government*, 1882. 14+247 p. 4°.

United States—Department of agriculture. Division of entomology. Bulletin. Nos. 1, 2. Washington, *Government*, 1883. 62, 36 p. 8°.

Urbanitzky, A. v. Das elektrische licht und die hierzu angewendeten lampen, kohlen u. beleuchtungskörper. Wien, 1883. 240 p., illustr. 8°.

Vámbéry, H. Der ursprung der Magyaren. Eine ethnologische studie. Leipzig, 1882. 599 p. 8°.

Woodward, C. M. Manual education a feature in public education. (A paper read before The national teachers' association, Saratoga, July 13, 1882.) Boston, *The Prang educational company*, 1883. 19 p. 8°.

Zaborowski, S. Nouvelles et curiosités scientifiques. Paris, *Marpon et Flammarion*, 1883. 525 p. 18°.

Zopf, W. Die spaltpilze. Breslau, 1883. 144 p., illustr. 8°.


I W COLBURN & Co.
Dynamo Electric Machines
Fitchburg Mass

AN OPEN LETTER.

TO THE EDUCATED PEOPLE OF THE UNITED STATES.

A few months ago the announcement was made that a company of eminent scientific men was formed for the purpose of establishing in this country a scientific journal of the highest character. The journal proposed was to be called "Science," which well indicates its scope and purpose. It was to be illustrated, and to appear weekly on Fridays. It was to be of convenient size for reading in the library or in travelling-conveyances. It was to be printed handsomely and accurately, and to be of suitable shape to bind into easily handled volumes Its contents were to be in extreme contrast with the majority of publications of the day. Every line was to be written by a thoroughly competent person, who was to be paid for his work. Not a word was to be inserted that had been influenced by any other cause than pure merit. Not a single "puff" or any kind of notice of any thing was to be printed for money-making purposes. Not an advertisement was ever to be inserted in any but avowedly advertising pages; and no advertisement was to be inserted if the editor thought best to decline it.

The company chose for its officers and directors: President, Daniel C. Gilman, the president of the Johns Hopkins University; Vice-President, Alex. Graham Bell, the inventor of the Telephone; Othniel C. Marsh, the president of the National Academy of Sciences; Gardiner G. Hubbard, long identified with the postal telegraph movement; and Samuel H. Scudder, the president of the Boston Society of Natural History.

It was proposed to offer to the public a journal which would, during the year, contain fifteen hundred pages of text, and to ask merely a subscription of $5.00; making, in fact, the cheapest scientific publication ever offered. Its contents were to give, in intelligible language, the scientific progress in every department of science in all parts of the world. And, although the requirements of scientific writing in some cases require technical language, every intelligent person can find in every issue a fair proportion of the contents wholly intelligible to him, and all of it of great interest and peculiar value.

It seems, therefore, that the enterprise is worthy of the active and positive encouragement of all the educated people of this country; and as the larger the paper's circulation, the larger will be its sphere of usefulness, we ask of you, first, to subscribe for yourself, and then to try to persuade others also to subscribe. In a short time a very handsome volume will be published, containing a classified list of subscribers to this new journal "Science." If you are not a subscriber already, we should be pleased to receive your subscription at once.

☞ *See front cover of this issue.*

MOSES KING, Publisher, Cambridge, Mass.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 1[illegible] cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

FRIDAY, MAY 11, 1883.

A STRANGE PERFORMANCE.

WHOM the gods would destroy, they first make mad. Mr. Hubert Howe Bancroft, having shown great capacity as an organizer of an encyclopaedia company, and having assumed not only to be an historian, but to dispense opinions oracularly, and to patronize and discredit distinguished writers, now throws the ethics of trade aside, and exalts himself to a place among self-praising martyrs. He gravely announces that purchasers of his earlier volumes must now subscribe to them over again in order to get the rest of the series, and sends out an extraordinary lithographed form of subscribing, in one corner of which is a list of the thirty-nine volumes, with the prices.

" ———— 188 .

"To HUBERT HOWE BANCROFT, San Francisco, Cal.

"*Dear sir*, — In token of my high appreciation of the value to the Pacific coast and to the world, of your long and arduous historical labors in a new field, and after a manner peculiar to yourself, I hereby tender my subscription to a complete set of your literary works in thirty-nine volumes, payments to be made at the regular published price as the volumes are issued and delivered.

"After your signature, please designate style of binding."

We doubt if a more flagrant piece of folly was ever perpetrated by a book-maker.

It is melancholy and significant, that while the few historical students, as tested in different centres, who are competent to pronounce on the value of Mr. Bancroft's History, are agreed in a qualified, and in some respects a condemnatory, estimate of its methods and performance, the general reviewers of the book have been simply dazed by its magnitude.

Any departure from laudation strikes Mr. Bancroft as inquisitorial, and unkind to a man who never made any pretensions to being an historian. Such a spirit is commendable and disarming; but when he becomes mad and militant, he arms his critics. Two protests against this universal flattery have struck him deeply.

These offenders are the *New-York independent*, which took up his claim of making a contribution in his notes to the bibliography of the subject, and which showed how preposterous such claim was; and the *New-York post* and *Nation*, which took him to task for his opinions on the early Mexican civilization, and for his churlish discourtesy to the late Lewis H. Morgan, — a man of pre-eminent reputation, whom Mr. Bancroft modestly accused of seeking to obtain a little cheap notoriety by attacking his (Mr. Bancroft's) views. Mr. Bancroft has made answer to these reviews in a tract, of which he requests an opinion, which we give him. He does not print or quote in any comprehensible way the articles which annoy him; and so the reader is left, unless otherwise informed, to infer the nature of these questioners' criticism from his own discourteous and specious language, which takes on a humorous sort of mongrel admiration in the juncture of such words as 'astute hair-splitter' and 'erudite dogmatist.' Without citing proofs, he accuses them of ignorance and mud-throwing, and thus makes but the vaguest responses to clear exemplifications of his own ignorance, to citations of the inadequacy of his index-mongery, and to instances of perversions, which the reviewers adduced. The reviews in question were severe, and, from the nature of the case, cutting; but they were not disfigured by foul language, and were explicit. His answer is vituperative and general. This pamphlet is eked out with extracts of laudatory comment growing out of the average conception of 'a big thing' from all sorts of sources, including a fresh commendation from certain California judges, who have no status, certainly, as students in this field, however reputable their legal qualifications and general intelligence. Some of Mr. Bancroft's gyrations are not more strange than the opinions which seem to have been wrung by him from various eminent people concerning this 'Macaulay of the west.' More than one distinguished gentleman has discovered to his annoyance, that polite sentences, in notes of acknowledgment for presentation

copies, have been used to swell this chorus of admiration.

He has another craze. He chooses to assert that there is a conspiracy among what he calls 'the Morgan men' to depreciate and crush him, and that these two articles are part of the plan. We suspect archeology is too engrossing a study for such trivial by-play; and we know, also, that the editors, whom he berates for lending themselves to such a plot, found students in the field too inclined to ignore his work, to bring themselves easily to the bestowal of any time upon criticising it. It is piteous to think how what might have been a useful labor is resulting in discredit and personal intrusiveness.

A STUDY OF THE HUMAN TEMPORAL BONE.—I.

IT may be asked why the writer of the present article should publish a subject which has already been so thoroughly and repeatedly investigated, is so familiar, and is treated with the utmost detail in many manuals of anatomy. In his experience as a teacher of anatomy, he has, of necessity, been obliged to observe many important points over and over again; and, as one of the results, he has been led to see some of them differently from the views commonly entertained. As no other bone is so complex as the temporal, and none more important in its relations, it occurred to him that his view of it might prove of interest to students. No discoveries are claimed, and it is probable that what is here written may be found in previous anatomical literature. In some points the details are less complete than those given in the admirable, accurate, and exhaustive 'Handbuch der anatomie' of Professor Henle; but others are perhaps more definitely indicated. For brevity, some of the more obvious details, given in every manual, are excluded.

For convenience of study and reference, it is usual to consider the temporal bone as consisting of the squamous, mastoid, and petrous portions, though these do not accord with the natural divisions observed in its development. To avoid circumlocution, the terms 'squamosa,' 'mastoidea,' and 'petrosa,' are substituted for the ordinary phrases 'squamous portion,' etc.

The *squamosa* is the irregularly circular or oval plate, upright in position, at the fore-part of the bone. Its outer surface, nearly flat or feebly convex, forms part of the temporal fossa. The inner surface is concave and pitted, as usual in the other bones of the cranium, and is marked by grooves for the great meningeal vessels. It is commonly defined by a fissure of variable extent, remaining as part of the petro-squamosal suture.

Projecting from the lower part of the squamosa, externally, is the *zygomatic process*, which articulates with the malar bone to form the zygoma. The base of the process is broad and strong, and has its upper surface slanting forward. The upper sharp border of the process is continuous backward with a curved line, the *temporal ridge*, which defines the squamosa from the mastoidea.

The squamosa underneath forms the articular surface for the mandible, consisting of the glenoid fossa with the articular eminence in front; both extending outwardly below the root of the zygomatic process. The *glenoid fossa* is a deep, transversely oval concavity, defined behind by the glenoid fissure. The *articular eminence* is a transverse ridge of variable thickness, convex fore and aft, and more or less concave to straight transversely. Variable prominences at the outer part of the articular surface are the *anterior* and *posterior glenoid processes*.

The *mastoidea* is the outer back part of the bone, externally defined from the squamosa by the temporal ridge. It is prolonged below into the conspicuous nipple-shaped eminence, the *mastoid process*. Internally, to the base of the process, is a large fore-and-aft groove, the *digastric fossa;* and internally to this again is a narrow groove for the occipital artery.

The broad archway between the mastoid and post-glenoid processes is formed by the *auditory plate*[1] (fig. 2, *d*), which extends inwardly as the roof of the external auditory meatus. It is partially defined from the temporal ridge by a variable, irregular crescentoid indentation.[2] The inner extremity defines the meatus from the tympanic cavity by an acute curved edge, from which a wide crescentoid plate, the *tympanic scute*,[3] slants upward, and forms the outer boundary of the upper portion of the tympanic cavity. The *scute* (fig. 1, *b;* fig. 2, *c*) can best be seen by sawing the temporal bone fore and aft through the tympanic cavity, and viewing the outer division of the bone from within. The scute is separated externally from the rest of the auditory plate by spongy substance, but occasionally is continuous through thick, compact substance. Its anterior border joins the

[1] Lamina auditoria. [2] Post-auditory fossa. [3] Scutum tympanicum.

tympanic tegmen, and its posterior border is continuous with the spongy substance of the outer wall of the mastoid antrum.

FIG. 1. — View from within of the outer portion of the left temporal bone, sawed through the tympanum, fore and aft, parallel with its inclination. *a*, tympanic margin of the external auditory meatus, formed below and at the sides by the grooved margin of the tympanic plate, and above by the margin of the auditory plate; *b*, acute, forming the outer boundary of the attic, *c*, tegmen; *d*, mastoid antrum; *e*, prominence of the inner posterior boundary of the attic; *f*, canal for the accommodation of the long process of the mallet; *g*, petro-squamosal fissure. Below *e* are seen the pyramid, and the aperture of the tympanic cord.

The inner surface of the mastoidea forms part of the posterior cranial fossa. Contiguous to the petrosa, it is impressed by the large curved channel for the lateral sinus. The upper border is defined from the squamosa by a notch, which receives the posterior inferior angle of the parietal bone. Usually a short canal[1] pierces the posterior border, from the outer surface to the groove for the lateral sinus, for the transmission of a vein.

The *petrosa* is a prostrate three-sided pyramid, with its base applied outwardly against the squamosa and mastoidea, and with its apex directed obliquely forward in the base of the cranium, between the occipital and sphenoid bones.

The posterior surface of the petrosa is the smallest, and forms an uneven slope at the fore-part of the posterior cranial fossa, defined outwardly by the groove for the lateral sinus. Internally, to its middle, is the *internal auditory meatus*, a short, wide canal for the passage of the auditory and facial nerves. Outward from the meatus is an oblique cleft of variable extent, sometimes large and conspicuous, and sometimes nearly obsolete. It communicates with a fine canal,[2] extending to the vestibule, for the passage of a vein.

[1] Mastoid foramen. [2] Aqueduct of the vestibule.

The upper border of the petrosa is an acute ridge, which continues outwardly to the upper border of the mastoidea, and gives attachment to the tentorium. It is usually marked along part of its course by a groove for the superior petrosal sinus, and its inner extremity is impressed by the trifacial nerve.

The posterior border of the petrosa is sharp and irregular, and joins the occipital bone. Its middle skirts the fore-part of the jugular foramen, and commonly exhibits two notches, separated by an angular process, which gives attachment to a partition of the dura dividing the foramen. At the apex it is usually marked by a groove for the inferior petrosal sinus.

The anterior border of the petrosa is the shortest; and it forms, with the squamosa, a notch, which receives the angular process of the sphenoid bone.

The anterior surface of the petrosa, broad and uneven, forms the posterior boundary of the middle cranial fossa. Above its centre, a conspicuous prominence, together with the contiguous depression internally, marks the position within of the labyrinth. Another depression in front of the apex accommodates the ganglion of the trifacial nerve, and the notch just below communicates with the carotid canal. The portion of surface below the position occupied by the labyrinth is formed by a wide, triangular plate, the *tegmen*,[1] which covers the tympanum, the mastoid antrum, and the eustachian tube. It is commonly more or less defined by a fissure, remaining as part of the petro-squamosal suture, which at birth extends from the notch at the bottom of the squamosa to that at its upper border. Frequently, also, a vascular groove, and several foramina for the transmission of vessels, mark the line of separation. The inner extremity of the tegmen is further somewhat defined from the rest of the petrosa by a groove directed outwardly, and ending in a small aperture, the *hiatus*[2] of the facial canal, for the entrance of the great superficial petrosal nerve. From the extremity of the tegmen, a narrow bar dips into the glenoid fissure, and separates the tympanic plate from the squamosa. The under part of the tegmen is commonly formed by a layer of spongy substance of variable thickness.

The inferior surface of the petrosa is very uneven. At its fore-part, outwardly, is situated the *tympanic plate*, originally a distinct bone from the rest of the petrosa. It presents a broad, concave surface, directed towards the glenoid fossa, and defined from this by the gle-

[1] T. tympani. [2] H. Fallopii.

noid fissure. It is produced below into a sharp, irregular crest, the *vaginal process*, variably extended into several uneven points.

The outer portion of the tympanic plate is produced into a cylindrical scroll, which forms the floor and sides of the external auditory meatus. The rough, crescentic border at the entrance of the latter is the *auditory process*, and gives attachment to the auricle. The scroll terminates at the inner extremity of the meatus with an abrupt *tympanic margin* (fig. 1, *a*), which is grooved along its course within for the insertion of the tympanic membrane.

The inner extremity of the tympanic plate closes the lower part of the eustachian tube.

Back of the vaginal process, and partially sheathed by a downward extension of the same, is the usually conspicuous *styloid process*. This is a narrow, tapering spine, of variable length, from half an inch to an inch or more, directed from the petrosa downward, forward, and inward. Before maturity it is commonly a distinct bone,[1] joined by cartilage to a short cylindrical base,[2] which occupies a pit or groove embraced by the vaginal process. Prior to puberty it is, for the most part, cartilaginous, and is usually lost in prepared specimens of the temporal bone.

Between the styloid and mastoid processes is the *stylo-mastoid foramen*, which is the exit of the facial canal. Behind it is a broad, mostly quadrate, articular facet, which joins the jugular process of the occipital bone. Adjacent, inwardly, is the *jugular fossa*, a concave recess of variable capacity, and commonly differing proportionately from that of the opposite bone of the same skull. It accommodates the commencement of the jugular vein, and forms the fore-part of the outer division of the jugular foramen. To its inner side is a pyramidal pit, which communicates at bottom with a fine canal,[3] extending to the cochlea, for the passage of a vein. The mouth of the pit extends downward in a groove, which forms the fore-part of the inner division of the jugular foramen.

Inwardly from the lower extremity of the jugular fossa, and behind the inner extremity of the vaginal process, is the entrance of the *carotid canal*. This ascends vertically, and then curves abruptly inward, and proceeds to the apex of the petrosa. It is sometimes incomplete at its inner fore-part, when, in the recent state, it is closed by fibrous membrane. It gives passage to the internal carotid artery and sympathetic nerve.

[1] Stylo-hyal. [2] Tympano-hyal.
[3] Aqueduct of the cochlea.

The uneven surface beneath the apex of the petrosa, at the fore-part, gives origin to the elevator of the palate, and, just behind, gives attachment to the pharynx. Back of this, the irregularly grooved part joins the occipital bone, having the interval occupied by fibrocartilage.

The *external auditory meatus*, or outer passage of the ear, in the prepared bone, communicates at bottom with the tympanic cavity. It is a curved canal, with the convexity upward, and is about two-thirds of an inch in length. It is directed from without inward, and a little forward and downward. Its cross-section is oval, with the longer diameter inclined forward. The roof, formed by the auditory plate, is extended to the greatest degree outwardly; while the floor and sides, formed by the tympanic plate, are extended most inwardly. The entrance is formed above by the narrowing of the broad arch of the auditory plate, and below by the auditory process curving up at the sides to the roof of the meatus. The *tympanic orifice*[1] (fig. 1, *a*), or communication with the tympanic cavity, is oval, or nearly circular, and very oblique, with its plane inclined outward and downward to an angle of about 50°. It is formed above by the sharp, curved tympanic margin of the auditory plate, and below by the horseshoe-like tympanic margin of the tympanic plate, grooved within for the insertion of the tympanic membrane.

The *glenoid fissure*[2] defines the tympanic plate from the fore-part of the squamosa, behind the glenoid fossa, and remains as a portion of the petro-squamosal suture. Its outer part is closed by anchylosis of the tympanic plate with the post-glenoid process. Its inner part receives a bar, dipping into it from the tegmen of the petrosa, and separating the tympanic plate from the squamosa. At its middle is a foramen, — the exit of a short, oblique canal[3] from the tympanum, for the accommodation of the long process of the mallet and the tympanic cord.

The *eustachian tube* is a short, oblique canal, communicating outwardly with the tympanum, and opening inwardly in front of the apex of the petrosa, at the notch between this and the squamosa. It is formed in front and beneath by the inner extremity of the tympanic plate, above by the tegmen, and behind by the anterior wall of the carotid canal. Its inner extremity is roughened for the attachment of the cartilaginous portion of the tube.

[1] Apertura tympanica.
[2] Fissure of Glaser; Glaserian fissure.
[3] Canal of Huguier.

At the upper part of the tube, extending into the tympanum, is the receptacle of the tympanic tensor muscle. This is formed by a thin, cylindrical scroll, commonly open along its fore-part, but closed in the recent condition by fibrous membrane. The upper extremity of the scroll tapers, curves outwardly, and projects as a short conical process[1] into the tympanum. Sometimes the receptacle forms a complete osseous tube, open only at the ends.

The *internal auditory meatus* is a cylindrical canal, about a third of an inch long, extending directly outward from near the middle of the posterior surface of the petrosa. The bottom of the meatus is directed forward and outward, and is applied to the base of the cochlea and to the vestibule. It is divided into two fossae by a transverse ridge, which expands, at the extremities, into the front and back walls of the meatus. In the upper fossa, internally, is the aperture of the *facial canal*,[2] by which the facial nerve leaves the meatus. The facial canal advances a short distance, and communicates, through the *hiatus*,[3] with the anterior surface of the petrosa. Turning abruptly outward and backward in the upper part of the inner wall of the tympanum, it then curves downward in the posterior wall, and ends under the name of the stylo-mastoid foramen. It is sometimes open along its course at the upper part of the tympanum, but is then closed in the recent state by fibrous membrane. Outward from the entrance of the facial canal is a concave recess, with a circular or oval group of minute foramina, which communicate with the *superior cribriform macula* of the vestibule. On the outer extremity of the transverse ridge of the bottom of the meatus there is a variable number of little pits, or foramina, usually two or three, which likewise communicate with the macula just mentioned.

The lower fossa of the meatus is impressed with a band-like *spiral tract*,[4] which is pierced along its course with numerous minute foramina. These sometimes exhibit a slight tendency to arrangement in little groups in longitudinal series; though I have never seen a specimen exhibiting even a well-marked approximation to the regularity represented in fig. 725 of Sappey's Traité d'anatomie, second edition. The foramina communicate with canals of the modiolus, and transmit the filaments of the cochlear nerve.

Centrally, at the termination of the spiral tract, there is usually a conspicuously larger foramen, which gives passage to the central artery of the modiolus.

Above the commencement of the spiral tract, and just below the transverse ridge, is a recess, variably distinct, sometimes scarcely marked from the spiral tract, sometimes forming a conspicuous depression or pit, with a little circular group of minute foramina, which communicate with the *middle cribriform macula* of the vestibule.

In the outer wall of the meatus, near the recess just indicated, is the aperture of a narrow canal, which is directed outwardly, and terminates in a group of minute foramina, which communicate with the *inferior cribriform macula* of the ampulla of the posterior semicircular canal. The three groups of foramina, communicating with the cribriform maculae, transmit the filaments of the three divisions of the vestibular nerve.

The *tympanic cavity* occupies a position at the fore-part of the petrosa, beneath the tegmen, and closed in front by the tympanic plate. It communicates outward with the external auditory meatus, outward and backward with the mastoid antrum, and inward and forward with the eustachian tube. Closed externally by the tympanic membrane, it forms the *tympanum*, or ear-drum, — an air-chamber intermediate to the external auditory meatus and the labyrinth. Within it are contained the ear-ossicles.

The tympanic cavity is obliquely placed parallel with the long axis of the petrosa. It may be regarded as consisting of two portions, — the main chamber, which may be named the *atrium*, situated directly opposite the external auditory meatus; and a recess above this, which may be distinguished as the *attic* (fig. 1, *b*).

The *atrium*[1] is discoid in shape, and is defined outwardly by the prominent edge of the tympanic orifice of the external auditory meatus. Its usual dimensions are about half an inch obliquely, fore and aft, and in height, and about two and a half lines from within outward. The inner wall is next the labyrinth, and in great part is visible through the external auditory meatus. It exhibits a conspicuous smooth eminence, the *promontory*, caused by the projection of the cochlea. The back part of this arches over a deep recess, looking backward and outward, and having at its inner side an aperture, the *round window*,[2] which communicates with the cochlea, and, in the recent state, is closed by the cochleo-tympanic

[1] Processus cochleariformis. [2] Aqueduct of Fallopius.
[3] H. Fallopii. [4] Tractus spiralis foraminosus.

[1] Atrium tympanicum.
[2] Fenestra rotunda; f. cochleae.

membrane.[1] Above the promontory, and over the position of the round window, is a concave recess, at the bottom of which is the *oval window*.[2] This is half oval or slightly reniform, with its longer diameter nearly horizontal, and it is directed outwardly. It communicates with the vestibule, and, when complete, is closed by the insertion of the base of the stirrup.

In advance of the oval window is the projecting end of the scroll or tube, which serves as a receptacle for the tympanic tensor muscle.

Below the promontory, curving fore and aft around it, is a concave, rough, cellular recess, which extends outwardly, and is defined by the tympanic margin of the tympanic plate. The lower part of the recess is the floor of the tympanum, situated above the jugular fossa; its back part forms the lower portion of the posterior wall of the tympanum; and its fore part, the lower portion of the anterior wall, situated just external to the ascending portion of the carotid canal. Above the recess, in front and inwardly, is the orifice of the eustachian tube. In front of this is the short, narrow, oblique canal, which opens into the glenoid fissure, and receives the long process of the mallet, together with the tympanic cord.

Within the posterior wall of the tympanum is the descending portion of the facial canal; and in advance of this is the receptacle for the stapedius muscle. The receptacle is a cylindroid cavity, about a fourth of an inch long. Ascending in front of the facial canal, it then curves forward beneath this, and tapers to an aperture at the summit of a little conical process, the *pyramid*. It is separated from the facial canal by a thin partition; but this is not unfrequently more or less imperfect, and is then, in the recent state, closed by fibrous membrane. The receptacle also communicates with the facial canal by one or two small canals for the passage of the vessels and nerve of the stapedius. The pyramid projects forward into the tympanic atrium, behind the position of the oval window. It is commonly connected with the contiguous wall by several little radiating bars, one of which joins the promontory. Between the pyramid and the recesses of the round and oval windows there are two vacant recesses.

Close to the back margin of the tympanic orifice of the external auditory meatus, a little below the level of the pyramid, is the opening of a small canal from the facial canal, which admits the tympanic cord into the tympanum.

[1] Secondary membrane of the tympanum.
[2] Fenestra ovalis, f. vestibuli.

The *attic*[1] of the tympanum is a pyramidal recess over the atrium, and above the tympanic orifice of the external auditory meatus. Its upper anterior boundary is the tegmen, which separates it from the cranial cavity, and is mostly provided with a layer of spongy substance of variable thickness. Its inner boundary is a convex prominence (fig. 1, *e*; fig 2, *b*) produced by the contiguous portions of the external semicircular and facial canals. Its outer boundary is the wide crescentic tympanic scute (fig. 1, *b*; fig. 2, *c*) of the auditory plate. It opens above the prominence of its inner boundary, outward and backward, by a large aperture[2] into the mastoid antrum. Beneath, it opens into the atrium by an elliptical aperture, formed internally by the ridge of the facial canal, and externally by the tympanic margin of the auditory plate. The attic is partially occupied by the mallet and anvil, which thence, by the handle of the former, and the long process of the latter, extend into the atrium.

The *mastoid antrum* (fig. 1, *d*; fig. 2, *f*) is a prolongation of the attic backward and

FIG. 2. — Section of the left temporal bone, through the squamosa, immediately in advance of the external auditory meatus. *a*, atrium of the tympanum, *b*, prominence on the inner back part of the attic; *c*, scute at the outer part of the attic; *d*, auditory plate, *e*, tegmen; *f*, mastoid antrum; *g*, anterior passage of the same; *h*, canal for the long process of the mallet; *i*, hiatus of the facial canal, *j*, eustachian tube.

outward in the spongy substance of the mastoidea. It is of variable size, ordinarily ranging from that of the attic to double the dimensions of this. It sometimes ends in a blunt, flask-like recess, but is oftener more or less extended downward among the cellules of the mastoid process. Frequently it gives off a smaller fork or passage (fig. 2, *g*), which is directed outward and upward among the

[1] Atticus tympanicus, upper chamber of the tympanum of Huxley.
[2] Petro-mastoid canal of Sappey.

cellules above the external auditory meatus; and rarely a third branch is directed more anteriorly.

While the atrium of the tympanum varies but little in size, the attic and mastoid antrum vary greatly.

The *mastoid cellules*[1] consist of air-cavities of variable number, size, and extent, in the midst of the spongy substance of the mastoidea. They are commonly more or less proportioned in number and size with age. With the advance of years, they increase in both respects from the conversion of the ordinary marrow-filled, spongy substance into vacant spaces. Later they increase in capacity by expansion and coalescence, and proportionately decrease in number; and often in old age some of them even exceed in size the antrum. The cellules communicate with one another, and, through the sides and extremity, with the mastoid antrum.

Some small but important foramina and canals of the temporal bone, besides those mentioned, are worthy of notice.

In the ridge separating the jugular fossa from the entrance of the carotid canal, there is a fine canal which ascends to the tympanum. It communicates with the atrium at the inner part of the floor, beneath the promontory, and is thence continuous with a groove ascending and dividing into several branches upon the latter. The canal gives passage to the tympanic nerve, which is distributed upon the promontory.

Among the nutritious foramina of the carotid canal, chiefly on its outer wall, there are several larger ones, which communicate with the tympanum, and transmit one or two minute arteries and connecting branches of the tympanic nerve with the sympathetic nerve.

Likewise, in the jugular fossa, there are several foramina communicating with the tympanum for the passage of minute veins. Another foramen in the fossa extends in a fine canal outwardly, and opens into the fissure between the mastoid and auditory processes. The canal transmits the auricular branch of the vagus nerve, and, in its course, communicates with the facial canal.

On the inner extremity of the tegmen, a cleft or groove ends in a fine canal, which proceeds outwardly to the inner side of the receptacle of the tympanic tensor, and communicates with the tympanum. The canal transmits the small superficial petrosal nerve. Another small groove on the tegmen, close to that for the large superficial petrosal nerve, likewise ends in a fine canal, communicating with the facial canal, for the transmission of the least superficial petrosal nerve.

[1] Mastoid sinuses.

THE WEATHER IN MARCH, 1883.

The floods reported last month have nearly subsided, though their evil effects will continue to be felt for many months. The Mississippi remained above the danger-line at Cairo till the 12th; at Memphis, till the 15th. It was two feet above danger-line at Vicksburg, and ten inches below the same at New Orleans, on the 31st. The heaviest losses were on the west bank in Arkansas, and here they were more serious than in 1882. It is stated, that on the 11th, to the south of Helena for a distance of two hundred miles, nearly the entire country for about thirty miles from the river was flooded, and a great number of cattle were lost. On the St. Francis River there was more devastation than in 1882; in the vicinity of Oldtown, near Helena, the flood was the worst ever experienced. The situation is more favorable at Memphis than last year. There will be no interference in planting the crops between Cairo and Vicksburg. And while, in 1882, at least 20,000 destitute people were supported more than a month by the government, the losses this year are confined mostly to the drowning of stock. The heavy rains of the 20th and 21st caused damaging freshets in the maritime provinces of Canada.

The chart on p. 386 exhibits mean isobars, isotherms, and wind-directions, for this month. A comparison with the similar chart for February, published in Science, April 13, shows that the winter area of permanent high pressure, which in February was very extensive, and nearly divided in two by the Rocky Mountain range, had moved to the east of that range, and was central in northern Montana. This area, in connection with the prevailing north-west winds, accounts for the low temperatures of the east. These present a marked deficiency in all sections east of the 97th meridian, the mean being 3.2° below the normal. The lowest temperature reported was −34°, on Mount Washington, the 5th.

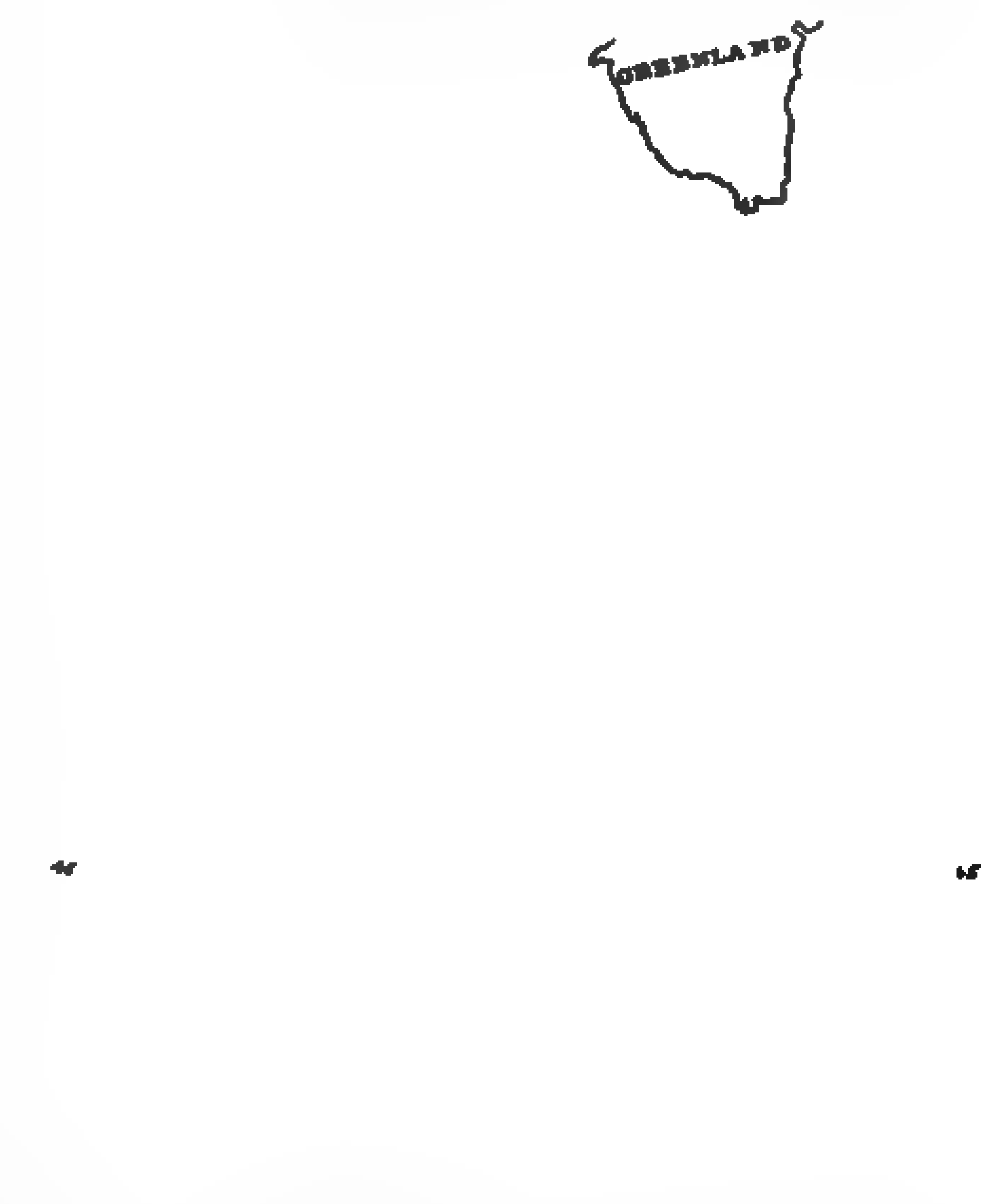
Eleven storms have been traced whose tracks lay either in the United States or a little to the north of the boundary. The following table exhibits the number and mean velocity of storms in each March since 1877, so far as they were sufficiently marked to enable a velocity to be determined.

MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, MARCH, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF THE CHIEF SIGNAL-OFFICER.

March storms.

YEAR.	NUMBER.	VELOCITY, MILES PER HOUR.
1877	11	34.5
1878	10	34.3
1879	13	35.2
1880	14	35.8
1881	9	26.5
1882	10	34.9
1883	11	36.0
Mean	11.1	32.8

Storm-tracks have also been drawn for the Atlantic: these show a much less stormy month than usual. During the first half, the movement of storm-centres was checked by an area of high pressure over the ocean, and extending from Europe westward to the 45th meridian. In consequence of this high area, easterly and south-easterly winds prevailed, thus favoring vessels bound westward. The lowest pressure reported was 29.1 inches, to the south of Newfoundland, on the 27th.



Icebergs and field-ice were most numerous in the parts of the ocean indicated by the shaded portion of the accompanying map, which shows the southern and eastern limits of icebergs in the North Atlantic, based on the reports of shipmasters, *New York herald* weather-service, and data published by the *New York maritime register*.

The precipitation was markedly less than in previous years; all sections east of the 97th meridian exhibiting a deficiency, except the South Atlantic States, +.4; Florida peninsula, +1.4; and the western Gulf States, +.6. The mean deficiency for this whole region was .76 inch. The threatened drought in the Pacific States, as noted in February, was broken by rains in the latter part of this month. These were sufficient to assure the success of the wheat-crop. Five feet of snow in the streets of Montreal were reported on the 7th.

The table in the next column gives the total movement of the air in March at several stations.

Total movement of air in miles.

STATION.	1881.	1882.	[illegible]
Eastport	11,409	9,704	11,069
Portland, Me.	7,985	7,026	7,579
Boston	9,826	9,425	9,259
New York	9,848	8,176	6,830
Mean	9,780	8,755	8,682

These figures show, with only a single exception, less movement during the present month than for three years. The air moved at the rate of 1,123 miles per day, or 34,800 miles during the month, across Mount Washington; and velocities above 100 miles per hour were reported on the 6th, 7th, 10th, 14th, 18th, and 25th. In the latter case the wind reached 150 miles in an hour.

Cautionary signals to the number of 117 were displayed; and of these, 115, or 98 %, were justified.

Auroras were seen on nearly every day of the month, but none very brilliant. The most extensive occurred on the 1st, 2d, and 3d. Professor Todd of Amherst reported sunspots, least in number on the 3d; and most, about the 24th. Earthquake-shocks were reported from Waterloo, Canada, between 10 and 11 A.M., of the 11th, and at 6.57 P.M., of the

same date, at Fallstown, Ind. On the 30th a wide-spread shock was felt in California.

L'HIRONDELLE.[1]

THIS name we find given to a carriage which is the result of one of the recent attempts to gain for the ordinary road-vehicle the ease of traction which a rail gives. It might be better to say that the actual result is the use of a much larger wheel than any that can be used in the ordinary way, and so the advantage which a large wheel gives in passing over obstacles on a rough road. The form shown in the cut is said to have been used in Poland and Russia with considerable success, and carriages of this type to have made their appearance in Paris. The driver's seat is connected rigidly with the shafts and with the three small grooved wheels which are made to fit the inner surface of the large steel ring, or wheel proper, which rolls on the ground. A screen is furnished behind, to give protection from the mud and dust, which, carried up by the outer ring, would be dropped on the hapless occupant. To give the whole stability, there are two outriding wheels connected with the main part by springs, flexible enough to allow of the main weight being borne by the central wheel, and yet sufficiently stiff to prevent any overturning. The most of the parts are made of wrought iron or steel. It has been found that the carriage is not liable to accident, and, with ordinary care, may be kept in running-order.

L'HIRONDELLE.

[1] This article, and the cut accompanying it, are taken from *La Nature* of April 14.

THE GREAT COMET OF 1882.[1]

THE accompanying sketches are intended to give an idea of the appearance of the nucleus of the great 1882 comet, in the 26-inch Washington equatorial, on the evenings of Feb. 1, Feb. 23, and Feb. 27, 1883. A magnifying

[1] Communicated by permission of Vice-Admiral Rowan, superintendent U. S. naval observatory.

power of about 200 diameters was used on each occasion for making the sketches.

Fig. 1 shows the comet on Feb. 1, 1883, at about the time of meridian transit, or 9h.,

Fig. 1. Feb. 1, 34, 1883.

Washington mean time. The nucleus which I first saw in any degree 'separated,' on the morning of Oct. 7, 1882 (its entire length at that time being about 25″), has now stretched out into a fine straight line of light, with three quite bright and stellar-like points of condensation. No micrometer measures were made; but, from a rough estimate, the distance between the two preceding points was about 35″, and the distance from the middle to the following point about 42″, the total length of the nucleus proper being about 80.″ The middle point was the brightest. The head shows no very definite outline, but on the south side it is somewhat brighter and more sharply defined than on the north.

Fig. 2 shows the comet on Feb. 23, 1883, just after meridian passage, or about 8h., Washington mean time. I can see but little change in the appearance of the nucleus since the first of the month, or, indeed, since the first part of December, except a gradual diminution in brightness. Three bright points are still visible. The middle one is brightest, and

Fig. 2. Feb. 23, 34, 1883.

about equal to a star of the twelfth magnitude; the point preceding is a little fainter than this; and the point following is the faintest. The light seems to be more concentrated near the preceding end. The position angle of the following point from the preceding was 76.5°; but the poor seeing and the increasing moonlight rendered it impossible to make any accurate measurements of the distance between these points.

Fig. 3 gives the appearance of the comet on Feb. 27, 1883, at about 8h. 30m., Washington mean time. The seeing was remarkably good, and the nucleus was examined with magnifying powers of 200 and 383 diameters. Four bright points were seen distinctly, and a fifth (*following*) suspected. Numbering these points of condensation in their order from the preceding end of the nucleus, 3 is decidedly the brightest, 2 next, 4 next, and 1 the faintest.

Professor Hall made a number of measurements of the distances of these points, and he has kindly furnished me with the following results of his observations: —

$$2 \text{ to } 3 = 34.5''$$
$$2 \text{ to } 1 = 48.1''$$
$$3 \text{ to } 4 = 22.3''$$

Fig. 3. Feb. 27, 36, 1883.

Position angle of the line joining 1 and 4 = 78°. This gives for the distance between the extreme points 1′ 44.9″. Using a value [0.45885] for the logarithm of the distance from the earth, interpolated from Professor Frisby's ephemeris, the apparent distance between our extreme points of condensation is 135,000 miles. If, however, these points lie on a line pointing from the sun, as this line makes quite a small angle with the line of sight at the time of observation, the real distance of our two points is about three times this value, or, roughly, 400,000 miles.

The comet was last observed on the 3d of March, but it is hoped that further observations can be obtained after the moon has passed. W. C. Winlock.

THE ERUPTION OF MOUNT ETNA.[1]

The last eruption of Mount Etna, although slight, has some interest, in that it was at a point farther down the mountain than any other in recent times, and the only one which has occurred on the southern side in this century.

The first warnings of the threatening eruption came from a series of earthquake shocks on the morning of March 20. Low underground sounds were heard, the reports succeeding one another at intervals of a few minutes. It was not until evening that it became evident where the eruption was to take place. At that time flames broke forth on the lower part of the southern side, about on the edge of the cultivated zone, and four kilometres north of the village of Nicolosi. Large clouds of vapor and gases escaped from cracks in the earth, and enveloped the mountain in a dense fog. By night-time a very red and bright light, which, viewed from Catania, appeared to play in large waves around the foot of the mountain, announced the appearance of lava. Eleven cracks formed during the night; and from them were thrown scoriae, which formed three heaps forty to fifty feet high. One jet of scoriae was thrown out with such violence that the shock caused the bells in the villages of Nicolosi and Pedara to ring.

The consternation of the people was the greater, as the locality was the same as that of the great eruption of 1669. This point commands a sloping plain which is highly cultivated, and on which are living, within a short distance of the centre of the eruption, a population of twenty thousand.

Eruption of Mount Etna, March 22, 1883. View taken from Catania.
1. The point of eruption, 2. Monti Rossi, 3. Village of Nicolosi.

The second day the character of the eruption became decidedly alarming. Some new fissures opened near Nicolosi, and the lava spread out in large waves over the neighboring country. This made the outlook very threatening; but, to the great surprise of all versed in the history of volcanic action, the eruptive movement began to abate, and during the night stopped entirely. This was fortunate, as the overflow of lava was from a point which might have caused great injury.

[1] Reproduced, with some modifications, from *La Nature* of April 14, together with the illustration.

The fact cannot be concealed, however, that the eruptive apparatus of this last upheaval has been left in a state which furnishes a constant menace to the neighboring villages. On account of the sudden cessation of action, the secondary phenomena have not taken place, by which nature usually brings about a permanent end to these parasitic craters. It is, then, among the possibilities of the near future, that another eruption may take place on the same spot where the late one has proved abortive.

MAGNETO-MOTIVE FORCE.

"Faraday compared a magnet to a voltaic battery immersed in water;[1] and he established by experiment the principal analogies on which this comparison is founded." Mr. R. H. M. Bosanquet, from whom the above is quoted,[2] thinks that too little has been made of this analogy, which seems to him to furnish the only sound view of magnetism. He would speak of a permanent magnet as possessing a certain 'magneto-motive force,' which, acting through a circuit made up of the magnet and the bodies or medium surrounding the magnet, produces throughout this circuit a total magnetic induction, equal to the quotient of the magneto-motive force by the 'magnetic resistance.' So-called magnetic substances are those in which the *magnetic conductivity* is great; and bodies of this sort, when brought near a magnet, become parts of the magnetic circuit, whose resistance they lessen, just as masses of metal placed in the water forming part of an electric circuit would lessen the total electrical resistance of such a circuit.

Moreover, a new distribution of the lines of magnetic induction is brought about by the entrance of the magnetic body into the field; this body receiving and transmitting a larger proportion of the lines of magnetic induction than the space it now occupies received and transmitted when filled by air. The body is now said, in ordinary terms, to be magnetized. At the same time, the lines of magnetic induction, being deflected from their most direct course, and bunched together where they approach the magnetic body to enter it, encounter in that region an increased air-resistance. A like condition of things exists in the air-region where they are departing from the magnetic body; and the effect of these increased air-resistances is to make the number of lines of magnetic induction through the body less than it would otherwise be. This air-resistance near the surface has for its equivalent in the ordinary theory the 'demagnetizing' action which the induced magnetism of a body exerts upon the interior particles of the body itself.[3] In the case of a very thin disk, magnetized by induction in a direction normal to its surface, the ordinary theory says that the demagnetizing action of the free magnetism of the surfaces almost neutralizes within the disk the effect of the external magnetizing forces, so that the magnetic induction in the disk is scarcely more intense than that in the air about it. The other theory explains the fact by saying that the superior magnetic conductivity of the disk is not able, acting for so short a distance, to seriously affect the course of the lines of induction in its neighborhood by making it advantageous for these lines to bend from their normal course in order to pass through the disk.

[1] Exp. res., iii. § 3276.
[2] Phil. mag., March, 1883.
[3] Faraday, Exp. res., iii., § 3289; Maxwell, arts. 426 and 438, old edition.

Mr. Bosanquet's article is an attempt to prepare Faraday's theory for use in numerical calculations by furnishing it with exact quantitative definitions, and to show by the results of experiment that the theory is fitted for such work. In doing this he thinks it necessary to make essential changes in well-known and widely received formulas.

Mr. Bosanquet states the ordinary theory thus: "Now, the fundamental hypothesis at the base of the ordinary mathematical theory of magnetism is, that there are magnetizing forces $\mathfrak{H}$ which are of the dimensions of the magnetic induction $\mathfrak{B}$ which they produce, and that the magnetizing force permeates every medium, and produces in magnetic media magnetic induction proportional to the force and to a co-efficient of permeability μ, quite independently of the existence of any magnetic circuit." To this Mr. Bosanquet objects; one of his objections being, that "we have to suppose that the magnetizing force $\mathfrak{H}$ within a magnetic body has the power of remaining separate and distinct from the magnetic induction as a whole, though the two are quantities of the same nature." In his theory "the quantity $\mathfrak{H}$ becomes merely the magnetic induction in vacant space, and $\mathfrak{B}$ that in magnetic matter. $\mathfrak{B}$ replaces $\mathfrak{H}$, and is not supposed to include it as before."

Instead of remaining

$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{J}, \text{ or } \mu = 1 + 4\pi\kappa,^1$$

"our fundamental equation becomes

$$\mu = 4\pi\kappa, \text{ or } \mathfrak{B} = 4\pi\mathfrak{J}."$$

The formula

$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{J}, \text{ or } \mu = 1 + 4\pi\kappa,$$

adopted by Maxwell and others, might, according to Mr. Bosanquet, lead to serious errors. Thus in a sphere of infinite magnetic permeability, magnetized by induction, Stefan, he says, has shown that "the ratio of the number of lines of force through its equatorial section to the number through the same section in air" is 3. Practically the same result is obtained from one of Thomson's papers, and Mr. Bosanquet confirms these results by a calculation in accordance with the views he is advocating.

He attempts now to show that Maxwell, using the formulas above, would make this ratio 4 instead of 3. A similar error would, he thinks, occur in calculating, according to Maxwell, the corresponding ratio for the case of a disk of infinite conductivity.

However interesting and suggestive certain parts of Mr. Bosanquet's paper may be, there is little doubt that he has here met the usual fate of those who attempt to convict Maxwell of error in reasoning. It is easy to show that Maxwell's formulas are in complete accord with the result above obtained from Stefan and Thomson. Thus (p. 66, vol. ii., old edition) Maxwell says that "in the case of a sphere the ratio of the magnetization to the magnetizing force is . . ., and if κ were infinite the ratio would be as 1 to 4.19," etc. This result Mr. Bosanquet quotes, but from that point he goes wrong. On the next page of Maxwell, where he is discussing the demagnetizing forces which the poles of a magnetized body exert upon the 'interior particles' of the body itself, we read, "If the magnet were a sphere the demagnetizing force would be $\frac{4}{3}\pi I$." The symbol I here, like $\mathfrak{J}$ in the formula above, means the intensity of magnetization.

Now, according to Maxwell, $\mathfrak{H}$[2] is not merely the original magnetizing force, which we will call $\mathfrak{F}$. It is this minus the *demagnetizing* force, which in this case is $\frac{4}{3}\pi I$. We have, therefore, from Maxwell,

[1] Maxwell, art. 428.
[2] Maxwell, arts. 398 and 426.

$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{J},\ \mathfrak{H} = \mathfrak{F} - \tfrac{4}{3}\pi\mathfrak{J},\ \text{and}\ \mathfrak{J} = \frac{\mathfrak{F}}{4.19};$$

whence

$$\mathfrak{H} = 4.19\,\mathfrak{J} - \tfrac{4}{3}\pi\mathfrak{J} = 0,$$

and

$$\mathfrak{B} = 4\pi\mathfrak{J} = 4\pi \times \frac{\mathfrak{F}}{4.19} = 3\,\mathfrak{F},$$

which is the result reached by Stefan and Thomson.

A precisely similar line of reasoning applies in case of the disk; the fact that $\mathfrak{H}$ in both the sphere and the disk becomes 0 explaining how it happens that $\mathfrak{J}\,[=\kappa\mathfrak{H}]$ remains finite, though κ is supposed infinite.

The fact seems to be, that Mr. Bosanquet does not understand the full meaning of Maxwell's $\mathfrak{H}$. He apparently supposes that it is the magnetizing force arising from external sources,[1] just what has been denoted above by $\mathfrak{F}$. Having, therefore, found that his own formula, $\mathfrak{B} = 4\pi\mathfrak{J}$, gives, in the case of the sphere of infinite conductivity, $\mathfrak{B} = 3\mathfrak{F}$, he naturally concludes that Maxwell would obtain $\mathfrak{B} = \mathfrak{F} + 3\mathfrak{F} = 4\mathfrak{F}$.

The two above-mentioned cases, then, are of interest, not as showing the inaccuracy of the ordinary formulas, but as instances in which Mr. Bosanquet's formulas hold good. In any medium possessing finite magnetic conductivity only, i.e., in any known medium, Mr. Bosanquet's formulas will evidently lead to results different from those given by Maxwell's; and it remains to be shown, I think, that Maxwell is in error.

Indeed, it is by no means evident that Maxwell's formulas need be essentially changed in order to be in accordance with the requirements of the theory Mr. Bosanquet is advocating; for, though Maxwell preferred to speak of magnetization as an induction phenomenon, he was, of course, perfectly well aware of its analogy to conduction, as might be shown by numerous quotations from his treatise, of which only one need be given.

"In many parts of physical science, equations of the same form are found applicable to phenomena which are certainly of quite different natures, as, for instance, electric induction through dielectrics, conduction through conductors, and magnetic induction. In all these cases the relation between the force and the effect produced is expressed by a set of equations of the same kind, so that when a problem in one of these subjects is solved, the problem and its solution may be translated into the language of the other subjects and the results in their new form will still be true."[2] E. H. HALL.

Cambridge, Mass., April 19, 1883.

[1] Maxwell does, in art. 437, use $\mathfrak{H}$ in this sense; but he does not use it thus in his formulas.

[2] Art. 62, new edition.

THE SMALL PLANETS.

THE following statement of the condition of the prize question of the Royal Danish society of sciences appears in *Copernicus* for March, 1883: —

The number of small planets between the orbits of Mars and Jupiter has by degrees become so large, that it is not to be expected that it will in future be possible to compute, in advance, the motion of every single one. And it will even be less possible to compute their influence singly on the motions of the large planets or of comets. Fortunately, however, the masses of the small planets are so trifling that the perturbation caused by any one separately may be left out of consideration; but it is very doubtful whether their collective influence might not be traced in the motion of the nearer planets or comets. In order that researches on this point should give a reliable result, it is necessary first to know the form and position of the ring formed by all the small planets, and the distribution of the masses in this ring.

No degree of accuracy can be attempted in the statistical description of the ring; and, with very few exceptions, the systems of elements already deduced for each planet may be adopted; the more so, as it will be of no importance whereabouts in its orbit a planet is at any time. As to the single masses, it is, of course, necessary to draw conclusions from the apparent brightness; but the number is so considerable that a fairly reliable result may be hoped for. In the statistical researches hitherto made, the separate elements only have been discussed, apart from their connection with the other elements; but this cannot be considered satisfactory. Thus the fact that the planets, arranged according to their mean distances, are divided into a number of distinct groups, does not, by any means, prove that the ring formed by them around the sun is dissolved into a number of fairly concentric rings.

The Royal Danish society of sciences, therefore, offers its gold medal (value 320 crowns, equal to nearly ninety dollars) for a statistical investigation of the orbits of the small planets considered as parts of a ring around the sun. The form, position, and relative distribution of mass, should, if possible, be stated with at least so much accuracy as is judged necessary for computing its perturbing influence on planets and comets.

The memoirs should be written either in Latin, French, English, German, Swedish, or Danish, and must be sent before the end of October, 1884, to the secretary of the society, Dr. H. G. Zeuthen, Copenhagen. They should not bear the author's name, but only a motto, while the name should be enclosed in a sealed envelope.

RESEARCHES ON THE DICYEMIDAE.

DR. C. O. WHITMAN has published an article[1] on these puzzling and imperfectly known parasites of the cephalopods. The number of genera is reduced to two, — Dicyema, with eight cells around the anterior end of the body; and Dicyemennea, with nine. The number of species is increased to ten, all of which are carefully described. Three are new.

As these animals have been taken by Ed. van Beneden as the type of a new division of the animal kingdom, and as they have been the subject of much discussion, we reproduce Whitman's summary. The dicyemids may be divided, according to the share they take in the work of reproduction, into monogenic and diphygenic individuals. The first produce only vermiform, the latter, first infusoriform, and then vermiform embryos. It is doubtful whether the two kinds of individuals are heterogeneous forms; for they are alike in origin, development, and adult form and structure; but their germ-cells, for unknown reasons, pursue different courses of development. There is a relation, the meaning of which is unknown, between the age of the host and the condition of the parasites; the nematogens predominating in the young, the rhombogens in the adult cephalopods. The rhombogens alone have a plurinucleate axial cell, which then contains, first, its own large nucleus; second, bodies, probably correspond-

[1] Mittheil. zool. stat. Neapel, iv. 1.

ing to polar globules, thrown off from the germ-cells before they develop into embryos; third, the 'residual nuclei' of the germogens set free, as the final event in the history of infusorigens. The infusorigen is a group of cells, consisting, at one period, of a peripheral layer of cells partially enveloping a large central cell. Its development from a single cell by a process of cleavage, and the epibolic growth of its peripheral layer, give ground for believing that it passes through a gastrula stage. In diphygenic individuals the germ-cells are different for the two kinds of embryos. The first to appear, one or two at a time, are the large germ-cells of the infusoriform embryos. After these embryos escape, there remain in the parent-body small cells, which multiply until they fill the greater portion of the axial cell, and eventually give rise to vermiform embryos. The difference between developmental division (cleavage) and multiplicative division of cells is here brought in striking contrast. No definite evidence of fecundation has been obtained, but it perhaps occurs with one form of embryo. In the development of the vermiform embryo, karyokinesis splits the germ-cell into two unequal parts. Then follows a three, and next a four celled stage, in which three cells form a cap over the fourth. This leads to a gastrula, in which a single entoderm-cell is enveloped by a small number of ectoderm-cells. The blastopore closes, and the multiplication of cells at this pole soon leads to the pyriform embryo, of which the pointed end is the blastoporal region; while the rounded end corresponds to the future cephalic pole. In this stage the first germ-cell appears at the hind end of the entoderm; the second germ-cell, at the anterior end; and from these two arise the other germ-cells. There is, therefore, a triploblastic stage, if we regard the two germ-cells as representing the mesoderm.

It may be added, that important errors of van Beneden have been corrected by Whitman, whose article is one of unusual interest and merit. As to the relationship of the dicyemids, Whitman says, "I see no good reason for doubting the general opinion that they are plathelminths, degraded by parasitism. Whether they, and their allies the Orthonectidae, have descended from ancestors represented now by such forms as Dinophilus, or from the Trematoda, is a question which further investigations must decide." C. S. MINOT.

TEMPERATURE AND ICE OF THE BAVARIAN LAKES.

AFTER an account of temperature observations on Swiss lakes by earlier observers, as Brunner and Fischer, Simony and Forel, A. Geistbeck (*Ausland*, 1882, 961, 1006) gives a detailed tabulated statement of his observations during 1881 on sixteen Bavarian lakes, showing the following results. As to variation with depth, the first six metres are almost constant; between six and eighteen metres there is a rapid cooling; then, to fifty metres, a slow decrease; and, below this, an almost constant temperature of a little less than 5° C. Daily variation is distinct to six metres, but ends at eighteen. Annual variation is reduced to from 0.2° to 0.9° at the bottom of the deeper lakes. Two groups are noted. The warm lakes, with an average temperature of 7.3° to 17°, are less than one hundred metres deep, their bottom temperature is below 5°, and they have a decided annual variation through their entire depth. The cold lakes, Königs, Starnberger, Walchen, and Achen, are from 115 to 196 met. deep, and, below fifty metres, are always cooler than 5°, with an average temperature of 5.2° to 5.6°: these have, therefore, a great volume of cold water even in midsummer, and a slow and small annual temperature range. The cause of this difference is seen partly in the depth of the lakes, and further in the relation of lake-surface to drainage-area, which, in the cold lakes, averages 1 to 10, and, in the warm, 1 to 30. Exceptions, here and elsewhere, to the rule of depth, are Barm (31.5 met. deep), Gosau (63), and Toplitz (105), which belong under the cold group; for, in spite of their moderate depth, they are well protected by steep shores from warming by sun and wind. On the other hand, Geneva (334) and Gmundener (190) approach the warm group, presumably on account of their large drainage-area. Certain small mountain-lakes, fed mostly by springs, show a relatively low summer and high winter temperature. Form of the bottom, and nearness to entering-streams, have strong control over the water's warmth. The lacustrine flora and fauna are determined chiefly by temperature and light. Reeds and algae are common along shallow shores, but all rooted plants end at a depth of twelve metres. The littoral molluscan and crustacean fauna disappears at twenty metres. In deeper water there is a special 'pelagic' fauna. (In this connection, see Forel, La faune pélagique des lacs d'eau douce, — *Arch. sc. phys. nat.*, viii. 1882, 230.)

The lake temperatures fall quickly in the autumn by circulation, but rise slowly in the spring by conduction and wave action. In winter a temperature lower than that of maximum density penetrates to a considerable depth: less than 3° has been found at forty metres. Ice forms first on the shallows along the shore, and spreads outward. The high lakes freeze every year, sometimes as early as October or September; the larger lower lakes, at later dates and more seldom. Walchen has frozen over only three times in this century; Constance, seven times since 1277; Gmundener, five times in the last four hundred years. In the severe winter of 1879–80 Tegern closed on Dec. 21; Zurich, in the middle of January; Walchen, on Feb. 3; and Constance and Gmundener, on the 6th. Changes of temperature produce long cracks in the ice, so characteristic as to have local names — *lehnen*, *schübe*, *wunen*, *frageln* — on the different lakes. Further description is given of the thickness and color of the ice, and certain peculiarities in the freezing of some of the lakes. W. M. DAVIS.

LETTERS TO THE EDITOR.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Zoölogical 'regions.'

MY attention has been drawn, by a notice in one of the last numbers of SCIENCE, to what seems to me to be sources of error. I refer to the determination of zoölogical regions by percentage calculations, and the idea that regions should have a certain amount of numerical equivalence. This seems to be an artificial and hence fallacious method of dealing with the subject, engendered by the lack of a proper conception of the matter under consideration. No definition or description of a 'region,' or synonymous word, can be found in any of the leading works on zoogeography; but, if we put two and two together, an idea can be formed which will, I hope, help solve some mooted questions.

Regions are known to differ in the kinds of animals occupying them, as well as in location. All, or all but one, are geographically very distinct; and all are well

separated in regard to animal distribution. This latter point goes far toward being the sole cause of regions. Any large mass of land separated from the rest of the world will, in the course of time, become inhabited by a peculiar set of animals, and obtain a comparative balance or stability of life. Thus a number of species are evolved which forms a sort of compound whole, — the life of a region. So a region may be defined as the area occupied by a peculiar grouping of animals which are isolated from the life of the rest of the world; the word 'peculiar' referring to the animals as a whole, and the isolation as of a limited and not absolute degree.

Accepting the above definition, the world can be conceived of as divided into regions, which, if the land and sea remained at rest, would be permanent, but constantly growing more and more distinct. But the land is not permanent. While the main mass is a fixture, minor changes occur, which join and separate the continents. As soon as two lands are joined, unless some other very powerful barrier exists, the life of the two at once begins to blend. The more potent kinds survive, while the weaker die out. The first, together with the life modified by the new conditions (new species evolved), in the course of time form a single region. On the other hand, if a land become divided into two, the reverse takes place, and two regions are formed. To me the palearctic and nearctic regions seem to offer illustrations of both these processes; the connection for life having been made and broken between the old and new worlds, probably by means of Asia, more than once. At present it is broken; and the nearctic and palearctic regions are formed or forming from a previous circumpolar region. With the tentative definition given here, the two are regions, since they do not form a group, and are separated. No lack of percentage differences can make the life of the two regions closely related: a change in one does not necessitate a change in the other. This also answers the circumpolar question: the resemblance in zones is due, first, to the imperfect obliteration of the old circumpolar region; and, secondly, to the fact that some of the forms which inhabited it have been driven down into the southward-pointing peninsulas, where the conditions of their life are easier. According to this definition, Madagascar should be regarded as the remains of a fading region, rather than a part of the Ethiopian. The resemblance between Africa and India is due to a southward migration which occurred not so long ago, very likely on account of the ice age, from a northern central point.

The above crude suggestions would seem sufficient to show that regions are more than numerical relations, and have an evolution of their own.

J. Amory Jeffries.

Panther Creek coal-basin.

I have just read your review of the Panther Creek atlas, in Science, No. 11, and my attention has been directed to what I consider a very just and proper criticism of two special features of the atlas sheets: 1°. The discordant scales of the mine (800′=1″) and topographical (1600′ = 1″) sheets. 2°. The use of the magnetic instead of the true meridian. As a geological critic, I should be disposed to boldly condemn what you have referred to as merely misfortunes. After an association of nine years with Professor Lesley on the Pennsylvania state survey, I am convinced, that, in the successful conduct of such a survey, it is quite impracticable to attempt to attain a purely technical and systematic standard of work. All that can be done is to approach as near as possible to such a standard, while meeting the practical demands for geological results, to aid in the economical exploitation of our mineral resources. This latter is what has popularized the work of the Pennsylvania survey, and accounts for its uninterrupted continuance with liberal appropriations for a state survey, since 1874.

The published results of the survey so far relate mostly to topographical, geotectonic, and stratigraphical geology in their economical bearings, with the exception of two volumes on paleobotany. Had any other plan than that of Professor Lesley's, which he has so efficiently carried out, been instituted, the survey would never have been so liberally supported by our state legislature, and probably would have been discontinued several years ago. The important thing in a state survey is to do the best we can. If we attempt too much, we fail in all.

In regard to the discordant scales and magnetic meridian, I would say: 1°. That the publication committee of the board of commissioners has never before authorized the printing of *general maps* on a scale larger than 1600′=1″. This scale was found quite too small for the anthracite-mine sheets, and it was only after the most careful consideration on the part of the committee that a scale of 800′=1″ was adopted for the mine sheets. The smaller scale was unfortunately adhered to for the topographical sheets, on account of the cost of publication. 2°. In the Panther Creek basin, the magnetic meridian of 1869 is always used in all surveys; and the block-lines referred to this meridian on the atlas sheets have been similarly placed on all the large working mine maps. In this form the sheets are of much greater practical value for ready reference. Had the publication of this atlas been delayed until the completion of the astronomical determinations of the survey in this locality, we should probably not have obtained an additional appropriation to continue the survey, which we now feel assured of receiving.

Charles A. Ashburner,
Geologist in charge.

Philadelphia, April 21, 1883.

Crayfish.

In August, 1882, while in Fairmount Park, Philadelphia, I found a crayfish in a brook emptying into the Wissahickon Creek. It had its under parts covered with young crayfish about one-eighth of an inch long.

Professor Huxley says that the English species, Astacus fluviatilis, lays eggs in May and June, and the young leave the female in a few days; but the young staid ten days with the female after I found them. There seems to be a difference in their habits in this respect. Last Friday, April 6, I found a female crayfish with young ones clinging to it, which I caught; and a friend now has it in a tank. Do crayfish lay eggs both early in the spring and late in the summer?

Richard M. Abbott.

Trenton, N.J.

[The writer of the above is eleven years of age. — Ed.]

Marking geodetic stations.

The writer of the article in Science of April 13, 1883, p. 269, in referring to the method of marking the geodetic stations in the N. Y. state survey, makes the statement that the U. S. coast survey stations are indicated 'by no surface-mark whatever,' trusting entirely to the underground-mark for the preservation of the station. The writer has, doubtless, been misled by visiting a station from which the surface-marks have been removed by curious or malicious persons. In the coast survey the greatest stress is

laid upon the importance of carefully marking stations; and the detailed instructions in regard to the subject occupy two quarto pages in the manual 'On the field-work of triangulation,' issued by the survey. The most common method used is the one which has been copied by the N. Y. state survey. Other methods, however, are used in special cases. For recovering a station, the main dependence is upon the surface-marks, and the underground-marks are used only for protection in case of the destruction of the others by accident or design.

H. W. BLAIR,
Assistant Coast and geodetic survey.

Washington, D.C.,
April 22, 1883.

Freezing of liquids in living vegetable tissue.

The conclusions of Mr. Meehan in relation to the above topic (SCIENCE, p. 229) seem to me scarcely warranted by the best authenticated facts in vegetable physiology. Experimental investigations and researches, undertaken many years ago, led me to the following deductions:[1] —

1. That the sap of many living plants can be frozen by the application of a degree of cold not much below that required to freeze it when removed from the plant; and that in very cold climates the sap of all perennial plants must be frozen in all parts during the winter months.

2. That the congelation of the juices of living vegetables does not, as many phytologists have imagined, necessarily and inevitably result in the death of the whole plant, or of the part in which it takes place, but, on the contrary, that frequently no injurious consequences follow. Consequently it is unwarrantable to assume that a plant which is not killed by severe cold never was frozen; and therefore it is unnecessary to invoke the aid of a 'vital power' to enable plants to survive the influence of cold sufficiently intense to freeze their juices when removed from the living plant.

3. That the bursting of the trunks of trees in high latitudes is not due to the expansion which the sap undergoes in process of congelation, but to the unequal contraction which takes place in the trunk (usually after the complete congelation of its juices) in consequence of a sudden depression of temperature. In short, that the rupture of the trunk in such cases is due to the same cause as the rents in the frozen ground, and the cracks in large sheets of thick ice, which occur in high latitudes when there is sudden accession of cold. This view is fortified by the fact that the coefficient of contraction (or expansion) of ice is greater than that of any other solid body hitherto examined, with the exception of hardened caoutchouc, or ebonite.

JOHN LECONTE.

Berkeley, Cal., April 17, 1883.

[1] For the exposition of the basis of these deductions, the reader is referred to the memoir of the writer, entitled "Observations on the freezing of vegetables, and on the causes which enable some plants to endure the action of extreme cold." — (*Proc. Amer. assoc. adv. sc.*, vi. 338–359; *Amer. journ. sc.* [2], xiii. 84–92, 195–206.)

Sun's radiation and geological climate.

In his review of Whitney's climatic changes, Mr. Gilbert says, "His [Whitney's] hypothesis that the intensity of solar radiation is gradually lessening, by reason of the dissipation of solar energy, . . . will be admitted by most students." Mr. Whitney and his reviewer fall into the very natural error, that a loss of heat, and, of course, of energy, is *necessarily* accompanied by a fall in temperature. Paradoxical as it may appear, a loss of both heat and energy may produce a rise in the temperature of the body that loses them. If it be true that the sun is, as is now thought by many eminent scientists, a globe of gaseous matter, then, under the long process of giving off heat, it has actually been growing hotter, and the intensity of its heat on the earth's surface to-day is greater than it was in the early geological epochs.

The world is indebted for this curious fact to Mr. J. Homer Lane.[1] I quote from Newcomb's Astronomy, p. 508: "The principle in question may be readily shown in the following way: if a globular, gaseous mass is condensed to one-half its primitive diameter, the central attraction upon any part of its mass will be increased fourfold, while the surface upon which this attraction is exercised will be reduced to one-fourth. Hence the pressure per unit of surface will be increased sixteen times, while the density will be increased only eight times. Hence, if the elastic and gravitating forces were in equilibrium in the primitive condition of the mass, its temperature must be doubled in order that they may still be in equilibrium after the diameter is reduced one-half."

Admitting, then, the gaseous condition of the sun, as, under our present knowledge, we seem compelled to do, we must also admit that the intensity of the sun's radiation of heat has been slowly increasing through the ages, and to-day is greater than at any previous time. The increase may have been small; but, so far as there has been any change, it has been in the direction of an increase, and hence cannot explain the undoubted decrease in the general temperature of the earth's atmosphere indicated by the paleontological record.

C. B. WARRING.

Distribution of public documents.

Few outside of the ranks of professional politicians will disagree with the report of the committee of Congress on the printing and distribution of public documents, or with the tenor of the editorial remarks on the subject in No. 9 of SCIENCE. But it is to be feared that it will be as difficult to induce the average congressman to dispense with these lubricants of the political machine as with the senseless distribution, through the department of agriculture, of seeds that can as well be bought at any country store. If any means can be devised by which the 'costly and beautifully illustrated volumes' shall reach those for whose information they were written, instead of serving to adorn the nurseries of influential ward strikers and campaign committee men, it will redound greatly to the benefit of scientific knowledge and progress; for at present it is mainly through the medium of second-hand book-stands that those interested can occasionally get the professional works of which their political insignificance did not render them worthy recipients.

There is one notable exception, however, to this extravagance and misdirection of precious documents, the result of one of those spasms of virtue mentioned in the editorial. I refer to the law concerning the distribution of the publications of the geological survey, to which director Powell has called attention in a circular issued some time ago. According to the terms of this law, these documents, excepting the general report, can be obtained only by purchase or exchange; that is, the scientific workers of the country may at first get what may be deemed the equivalent of their own publications, or, possibly, of rare works in their possession. But when this resource is exhausted, the only method open to them, for obtaining what in many cases is the sequel of

[1] See *Amer. journ. sc.*, July, 1870.

their own work in the states, is to purchase the memoirs out of their abundant professorial incomes. What that means when it comes to the illustrated memoirs and atlases, most needed by the actual worker, is too obvious to need discussion. They will simply have to be done without by those not within reach of a large public library.

Heretofore, a certain number of copies of such publications, outside of those placed at the disposal of congressmen, were distributed gratuitously to those known to be actively interested in the subject, by the authors, or heads of surveys, who knew exactly whom to reach among their scientific co-workers; and the stimulus thus given to research and scientific intercourse was very great. All this is now effectually embargoed: the very men whom these documents should reach are cut off from them by this penny-wise and pound-foolish legislation.

If it be true that the United States cannot afford to continue the expenditure involved in the gratuitous distribution of such costly publications, even for the encouragement of scientific research, it would be far better that their cost should be reduced from the magnificent quartos and royal folio atlases to such material and dimensions as *can* be afforded consistently with a judicious gratuitous distribution, intrusted, for example, to the judgment and discretion of the director, the Smithsonian institution, and the National academy, severally or jointly. The scientific publications would then be quite sure not to be wasted, and yet would with equal certainty reach those whose active interest in the progress of science should entitle them to their possession. This is the more needful, since the extension of the national survey into the states will, for the time being, undoubtedly render state surveys less numerous, and more scantily endowed for scientific work; so that the publications of the national survey will be the chief source of information hereafter. It does seem that what the states could afford to do gratuitously for their own citizens could be afforded by the national government, now that this kind of work has practically passed into its hands.

E. W. HILGARD.

Berkeley, Cal., April 19, 1883.

THE AGRICULTURAL EXPERIMENT-STATION OF CONNECTICUT.

Annual report of the Connecticut agricultural experiment-station for 1882. New Haven, *State*, 1883. 114 p. 8°.

THE major portion of this report is, as usual, occupied with analyses and valuations of commercial fertilizers, and divers other fertilizing materials, and though valuable in its way, and in accordance with the design of the station, contains little of general scientific interest. The review of the fertilizer-market for the past year, on pp. 56–60, must prove of considerable aid in the valuation of fertilizers, and will doubtless attract the attention of both manufacturers and consumers.

Among the fodder analyses are two of duplicate samples of field-corn and of fodder-corn, selected with especial care, and also of ensilage from the same material. These analyses disclosed the interesting fact, that the duplicate samples of the same material differed more in some cases than did the ensilage and the fresh substance. These results illustrate the great difficulties that stand in the way of preparing a fair sample of such a bulky plant as maize, and throw considerable doubt on the accuracy of some of the recently published results regarding the changes which maize undergoes in the silo.

The most generally interesting portion of the report is the paper on 'Milk,' by Dr. E. H. Jenkins, which includes the results of several analyses of the milk of single Guernsey cows, and of over two hundred partial analyses of the mixed milk of herds. These results afford valuable data in regard to the variations which may occur in commercial milk, and the possibility of establishing by law a standard of purity for milk. In regard to the variations in the milk-solids, "an inspection of all the results . . . leads to the conclusion, that, in pure herd-milk, the solids may in some cases, and at certain seasons, sink as low as 10 or 10.5 per cent, and the fat to 2.6 per cent; and that very frequently (in 28 per cent of the samples examined at this station) the solids are less than 12 per cent."

In one case the total solids amounted to only 9.79 per cent, though it was not *certain* that the milk was unadulterated, and, in six cases out of two hundred and seven, to less than 10.5 per cent. Dr. Jenkins comes to the following conclusions regarding the standard of purity for milk: —

"As evidence of watering, simply, specific gravity furnishes by far the most satisfactory test; and, if 1.029 is adopted as a minimum, no pure milk will be condemned. In some cases moderately watered milk may escape detection.

"If we will establish a minimum limit for the percentage of solids and fat which shall in no case condemn pure milk in any locality, we shall have to make it absurdly low, and thus offer a premium on watering milk of good quality."

While evidently doubting the practicability of establishing a general standard of purity for milk, Dr. Jenkins thinks it possible to establish by mutual consent *local* standards for limited districts, where the pasturage and other conditions are tolerably uniform. Where this is done he would not have the question of the *purity* of the milk raised at all, but would simply condemn all which falls below the standard as too poor to use. Both suggestions seem worthy of general consideration.

FOSSIL BOTANY.

Cours de botanique fossile fait au Muséum d'histoire naturelle. Par M. B. RENAULT. 2ème année. Paris, *Masson*, 1881. 194 p., 24 pl. 8°.

IN the first volume of this remarkable work, which was reviewed in this country a year since (*Proc. Amer. phil. soc.*), the author has exclusively considered the Diploxyleae, and given the history of each of the families of that class, — the Cycadeae, Zamiae, Cycadoxyleae, Cordaiteae, Paroxyleae, and Sigillariae. As the question of the relation of the Paroxyleae and Sigillariae is of the greatest importance for the history of the evolution of plants, it has been considered again in this year's course, though, in the preceding, the structure of the Sigillariae had been already examined. The author therefore proposes to study the most highly organized vascular cryptogams, and to search by studying the anatomy of the stems, the branches, and the roots, if, as has been asserted, any of them, at a certain point of their existence, take on the phenogamic character so distinctly that a separation of these two great divisions becomes impossible.

The essential characters of the vascular cryptogams to be examined are presented in a table. They are divisible into two prominent groups: 1°. The Lycopodiaceae and the Rhizocarpeae, which are heterospores, though some Lycopodiaceae are both heterospores and isospores; 2°. The Ophioglosseae, the Equisetaceae, and the ferns, which are isospores.

The first group of the Lycopodiaceae is that of the Lepidodendreae, beginning in the first chapter with the genera Psilophiton and Lepidodendron. Chapter 2 examines in detail the anatomical structure of three types of Lepidodendron; viz., L. Rhodumnense, L. Harcourti, and L. Justieri. Chapter 3 relates to the anatomy of the fructification of Lepidodendron or to the Lepidostrobi. Chapter 4 gives a brief examination of the characters of the other genera referred to the Lycopodiaceae. Chapter 5 compares the distinctive characters of Sigillaria and Lepidodendron, the differences, after discussion, being set forth in a comparative table; the Sigillariae being recognized as related to the phenogamous plants, and the Lepidodendreae to the Lycopodiaceae.

To the Rhizocarpeae belong, at the present epoch, the genera Pilularia, Marsilia, Salvinia, and Azolla. Of these, no remains have been found in the carboniferous; but species of the genera Sagenaria and Sphenophyllum seem to be related to this family. The history of the genus Sphenophyllum, as heretofore known, and the description of the species, are given in chapter 6. The anatomical structure of Sphenophyllum is discussed in chapter 7; the woody axis is always full, not hollow, and inflated at the articulations only when a branch is formed; the stems, the leaves, the bark, the roots, the fructification, are treated.

With chapter 8 begins the treatment of the cryptogamous isospores, which may be summarized as follows: Equisetaceae. — The living plants of this family have only one kind of spores; examination of the stems and other organs. Asterophyllites. — Tiges, branches, and principal species described; two forms of fructification described (Wolkmannia and Macrostachya). Chapter 9. Annulariae. — Description of the different organs; stems, branches, and fructification; and of the species. Chapter 10. Fructification of Annularia, considered with species of uncertain relation (Bruckmannia and Cingularia). This chapter ends with a comparative table exposing the characters of the Asterophylliteae and the Annulariae. Chapter 11 contains descriptions of the genera Schizoneura, Phyllotheca, and Equisetum. Nine species of Schizoneura and twenty of Equisetum are described, none from the paleozoic formations. The genus Calamites and its different organs are described in chapter 12.

The concluding chapter contains a table showing the different formations where the plants described in the volume have been obtained. The true Equisetaceae do not appear lower than the trias. The range of Asterophyllites, Annularia, Calamites, and the Lycopodiaceae, is from the upper Permian to the culm or subcarboniferous measures; that of Psilophitum is in the Devonian and upper Silurian. The volume ends with considerations on the distribution of the plants, on the climate as indicated by their nature, and on certain organs which may be useful in classifications. It would be useless to eulogize this excellent work, which is illustrated with twenty-three splendid plates. The above summary sufficiently shows its importance.

A NEW CALCULATION OF THE ATOMIC WEIGHTS.

Die atomgewichte der elemente, aus den originalzahlen neu berechnet. Von Dr. LOTHAR MEYER und Dr. KARL SEUBERT. Leipzig, 1883, *Breitkopf & Härtel.* 246 p. 8°.

THE great importance to chemistry of an exact knowledge of the atomic weights is well illustrated by the recent activity of chemists in

that line of investigation.' About two years ago, Prof. G. F. Becker published his 'Digest'; a year later my own 'Recalculation' appeared; and now comes a third volume on the subject by Professor Lothar Meyer and Dr. Karl Seubert of Tübingen.

A comparison of this new work with the other two shows, that, in general terms, it is intermediate between them in its character. Becker collected the data relative to atomic weights, and brought them into systematic shape, but attempted no thorough recalculation. Meyer and Seubert classify and recalculate the published weighings, and make many valuable reductions of apparent weights to absolute or vacuum standards; but, with a few exceptions, they do not attempt to combine the work of different investigators, and they reject the method of least squares as inapplicable to the data at hand. My own effort was to reduce determinations as far as possible to common standards, to combine all similar data into general means, and to compute from all the evidence the most probable values for the atomic weights of the different elements. In so doing, I applied the method of least squares, and I see as yet no reason for discrediting that manner of discussion. Each of the three volumes fills a definite place; and, in any future revision of the field, each will be found a useful supplement to the others.

In general, the results obtained by Meyer and Seubert differ but slightly from mine. In comparing the atomic weights of sixty-six elements, the difference between the two recalculations falls within a tenth of a unit in thirty-seven cases, and is greater than a tenth in twenty-nine; but among the latter are found most of the rarer and less perfectly known metals. In many instances the differences are due to a trifling fundamental difference in the value assigned to oxygen. The Meyer-Seubert value is $O = 15.96$; mine is $O = 15.9633$: and this slight variation in the third and fourth decimal places sometimes is multiplied among the higher atomic weights to an appreciable amount. Where the two recalculations agree, they serve to confirm each other: where they differ, they indicate the important fields for further investigation. Most of the differences, however, are mainly due to differences in the manner of computation.

In some respects the new recalculation is open to criticism. Inasmuch as Meyer and Seubert rarely attempt to combine the available data, they are, perforce, compelled, in dealing with each element, to select more or less arbitrarily the results of one investigation, and give it preference over all the others. This they do without assigning reasons for their choice; and such a lack of critical statement is much to be regretted. Again: the arrangement of the material is inconvenient, notwithstanding the fact that there is a well-classified index, both for elements and for authors. For example: aluminum, instead of being discussed in a division by itself, is treated in separate ratios on pp. 22, 23, 83, 139, 151, and 193; and a comparison of the results of different investigations is thus rendered a very troublesome matter.

Some omissions are noteworthy, and seem difficult to explain. Such, for example, are Cleve's determination of the atomic weight of scandium, Julius Thomsen's synthesis of water, and Russell's hydrogen series for cobalt and nickel. Russell's work on the oxides of these metals is given, and his results receive final acceptance; but wherein they are preferable to those of Lee is not stated. Another curious set of omissions occurs under antimony. Here are cited Professor Cooke's latest bromide series, and his set of results comparing the trisulphide with the chloride. But his syntheses of sulphide from the metal, and his valuable iodide series, are altogether ignored, while his earlier bromide series barely receives mention. Finally, nothing is said concerning Dumas' investigations upon the occlusion of oxygen by silver, although no recalculation of the atomic weights can safely ignore so important a factor. F. W. CLARKE.

WILDER AND GAGE'S INTRODUCTION TO ANATOMY.

Anatomical technology as applied to the domestic cat: an introduction to human, veterinary, and comparative anatomy. By BURT G. WILDER, B.S., M.D., and SIMON H. GAGE, B.S. New York and Chicago, *A. S. Barnes & Co.*, 1882. 25+575 p. l. 8°.

THIS book the authors state to have grown out of their needs as instructors of students preparing for practical work in human, veterinary, or comparative anatomy. To students of the first and second of the above classes there is no doubt it will prove extremely useful. It is probably correct to say, that, although containing a good deal of irrelevant matter, and blemished by the unnecessarily extensive employment of a novel terminology, it contains by far the best set of directions for the dissection of a mammal below man in the scale, ever published for the use of that large class who prefer or are compelled to enter

on professional study without any thorough preliminary training. The bodies of horses or oxen are large and costly for elementary work, and, owing chiefly to defective legislation, in many states anatomical material is apt to be scarce in medical schools. Hence, for many years, good directions for the anatomical study of some easily obtainable mammal of convenient size have been a desideratum. The lad who has properly dissected a cat knows already a good deal of human or equine anatomy. He has not to learn, in his so often disgracefully brief medical course, how to use his scalpel; he knows what a humerus and a cerebral hemisphere are; iliac artery and median nerve are not strange and unmeaning names to him. In consequence, he can from the first profitably confine himself mainly to those special points in human, equine, or bovine anatomy, which have direct bearing on the future practice of his profession.

For those who intend to study comparative anatomy, or who have a year or two to devote to preparatory scientific studies before entering a medical school, we cannot agree with the authors that the cat is a good animal to begin with. By those students who desire some scientific anatomical knowledge, and have time and opportunity to acquire it, so high a type as the mammalian ought only to be taken up after thorough study of several lower and simpler forms. It is in connection with this fact that we think it unfortunate that the authors have made such unsparing use of new names. To the scientific student a simple and uniform terminology, applicable to all vertebrates without confusion, is worth the trouble of learning. But the great majority of those who will find this book useful will be lads desiring to acquire some knowledge of anatomical technique and phraseology as an aid to future professional, specialized, non-scientific study of the body of man or of certain domestic animals. It would surely be better for this purpose that (to take an example) students should learn to know, read, and speak of the cavities in the encephalon as the ventricles of the brain, the name under which they will find them in their professional text-books, rather than be taught to call them procoelia, diacoelia, epicoelia, and so forth. So far as the employment in the laboratory of the book itself is concerned, we must add, however, that the nomenclature and terminology employed have proved much smaller obstacles to its usefulness than we expected. When we first got hold of it, and read such directions as 'dorsiduct the tail,' and such statements as 'the cranium is the caudal part of the skull,' we feared that the class on whom we proposed to try it would have a bad time. The men did grumble a little at first, but very quickly got to interpret easily all the new adjectives used in the text, and even to like them as facilitating brevity of description. This experimental evidence of the value of the nomenclature adopted may outweigh the apparent disadvantage of teaching students to call things by names which they will rarely if ever afterwards hear applied to them.

The first eighty-six pages of the book are occupied with introductory remarks on anatomical technology, and things in general. Many of them will be of great value to students who have to work without the supervision of a teacher; and also make the book a good one to put in the hands of a laboratory servant. It is very convenient to have directions for preparing injections and preservative liquids, for keeping the animals in good health, for anaesthetizing or killing them, and for cleaning and sharpening instruments, collected and printed as we here find them. There is, however, in these useful introductory pages, a considerable amount of superfluous matter. It may be necessary, though we doubt it, to inform the reader what is a fair price for a good scalpel or from what firms in the United States he may buy a suitable pair of scales; but an account of the metric system and metric bureau, and of good methods of exciting interest in metric measurements, is out of place in a dissector's handbook: a table of comparison of the ordinary and the metric weights and measures is quite enough. A discussion of the rules of simple arithmetic would have been as suitable, as an appendix to the formulae for interconverting the Centigrade and Fahrenheit thermometric scales, as is the account given of the metric system. Similarly, most of the 'Rules and aphorisms of general application' are about as much in place in an anatomical text-book as would be the sermon on the mount: they are admirable of their kind, but one is puzzled to know what they are doing in this gallery.

The book, however, is, in spite of some oddities, an honest piece of work, and will have permanent value: it is a real contribution to our knowledge of cat anatomy. Though many of its novelties in nomenclature are we believe unnecessary, and subjects are discussed which have no pertinence to the matter in hand, yet it will most undoubtedly prove of great use to a large class of students, and, we will add, to all teachers of vertebrate anat-

omy. We only wish the publisher had done as well as the authors. The illustrations are numerous, and probably sufficient to fulfil the end of helping the student in his work; but, from an artistic point of view, they are, with rare exceptions, simply atrocious.

MINOR BOOK NOTICES.

Guesses at purpose in nature, with especial reference to plants. By W. POWELL JAMES, M.A. London, 1883. 192 p. 12°.

THIS is a little book of ten chapters, which has just reached us, and which we would notice with a word or two in addition to an announcement of its title. The author, we fancy, is a clergyman and merely an amateur naturalist. However that may be, his *guesses* are shrewd, and the way of putting them is taking. Considering the great number and variety of the facts he has collected, — the greater part from books, — he has fallen into few mistakes; so that the volume has more scientific value than is usual in such treatises.

An outline of qualitative analysis for beginners. By JOHN T. STODDARD, PH.D, professor of chemistry in Smith college. Northampton, *Gazette printing company*, 1883. 4+54 p. 16°.

The general plan of this work will doubtless be recognized as one which gives the best results in teaching qualitative analysis. To a certain extent it is faulty in detail, both as regards convenience of arrangement and the selection of methods. Although this criticism applies more especially to the course of basic analysis, if advantage were taken of differences in solubility of certain barium, calcium, and silver salts of the acids, it would save the student much time and labor in general analysis. An appended list of the names and symbols of the more common reagents will be found useful.

A short course on quantitative analysis. By JOHN HOWARD APPLETON, A.M., Brown university. Philadelphia, *Cowperthwait & Co.*, 1881. 183 p., cuts. 12°.

The course of analysis presented in this work consists, with few exceptions, of a judicious selection of methods and determinations. The descriptions of processes and apparatus will undoubtedly be of much service in the laboratory, although considerable descriptive chemistry is introduced with which the student is supposed to be familiar before undertaking quantitative analysis. An exception will probably be taken to the completeness of the notes and explanations, which leave little opportunity for thought or study on the part of the student.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Alignment curves on the ellipsoid. — Mr. C. H. Kummell describes several curves that represent the straight line, all of which, on the sphere, reduce to the great circle. The *vertical section* is traced by the surveyor at one end, who fixes points in range with the other end. The *proörthode* (πρό, ὀρθός, ὁδός) results, if the alignment at each point is determined at a point previously fixed, the distance between the two being infinitesimal. It is followed in chaining, or more roughly by the pedestrian in moving toward an object. In these two curves no back-sight is taken: they are differently related to the two ends, and do not return upon themselves. The *diorthode* (διά) is the locus of all points at which the vertical plane through one terminal point also includes the other. It is used in laying out primary base-lines, the points of which are determined by making fore-sights and back-sights differ always by 180°. This curve has been confounded with the preceding by Dr. Bremiker (*Studien über höhere geodäsie*, 1869) and others; but the proörthode is everywhere tangent to the vertical plane passing through one terminal point, while the diorthode, except at the ends, is not. The curve of shortest distance between two points, often called the 'geodetic line,' would more properly be called the *brachisthode* (βράχιστος). These names were suggested by Mr. W. R. Galt of Norfolk, Va.

Mr. Kummell shows the diorthode to be the intersection of the ellipsoid with a hyperboloid of one sheet. In the case of an ellipsoid of revolution, this is the parabolic hyperboloid. Taking the three principal axes, a, b, c, as axes of x, y, and z, he represents the points where the chord connecting the two termini of the proposed alignment pierces the planes xy, xz, yz, by $(x_z, y_z, 0)$, $(x_y, 0, z_y)$, and $(0, y_x, z_x)$, respectively, and introduces quantities, —

$$\alpha_b^2 = 1 - \frac{a^2}{b^2}, \quad \alpha_c^2 = 1 - \frac{a^2}{c^2},$$

and so, by cyclic permutation of letters, β_c^2 and β_a^2, γ_a^2 and γ_b^2; where the ratio of each of his first set of auxiliary quantities to one of his last gives one of the co-ordinates of position of those generatrices of the hyperboloid which are perpendicular to the co-ordinate planes. The equation of the hyperboloid is, —

$$\left(x - \frac{x_y}{\beta_a^2}\right)\left(y - \frac{y_z}{\gamma_b^2}\right)\left(z - \frac{z_x}{\alpha_c^2}\right) = \left(x - \frac{x_z}{\gamma_a^2}\right)\left(y - \frac{y_x}{\alpha_b^2}\right)\left(z - \frac{z_y}{\beta_c^2}\right),$$

and it passes though the centre of the ellipsoid.

The diorthode cannot be traced practically, because of the curvature of the earth. Mr. Kummell has investigated the locus of all points through which one tangent line meets the normals drawn at the two extremities, and finds its intersecting surface to be of

the fourth degree. — (*Phil. soc. Wash., math. sect.; meeting* April 26.) [811

PHYSICS.

Electricity.

Testing insulation of electric-light wires. — Mr. C. J. H. Woodbury described a compact piece of apparatus, consisting of a magneto-electric machine and a pair of electric bells. The machine will produce a current strong enough to ring the bells through a resistance of seven thousand ohms. By connecting one pole with the electric-light system, and the other with the ground, the insulation of the system may be shown to be more or less than about seven thousand ohms, according as the bells ring or not. The method has been found useful in the inspections now made in the interest of fire-insurance companies. — (*Frankl. inst., meeting* April 18.) [812

Electrical transmission of power. — Dr. C. W. Siemens, in the course of an address at the Institution of civil engineers on March 15, after describing the well-known experimental electrical railways of the Berlin and Paris exhibitions, stated that an electrical railway six miles in length had just been completed in the north of Ireland. In this instance the two rails, three feet apart, were not insulated from the ground, but were joined electrically by means of copper staples, and formed the return circuit, the current being conveyed to the car through a T iron, placed upon short standards, and insulated by means of insulite caps. For the present the power was produced by a steam-engine at Portrush, giving motion to a shunt-wound dynamo of 15,000 Watts, or 20-horse power. The working-speed of this line was restricted by the board of trade to ten miles an hour, which was readily obtained, although the gradients of the line were decidedly unfavorable, including an incline of two miles in length at a gradient of 1 in 38. It was intended to extend the line six miles farther, in order to join another railway system. The electric system of propulsion was, in the lecturer's opinion, sufficiently advanced to assure practical success under suitable circumstances; such as for suburban tramways, elevated lines, and, above all, lines through tunnels. The lecturer, however, did not advocate its prospective application in competition with the locomotive engine for main lines of railway. — (*Nature*, March 29.) E. H. H. [813

ENGINEERING.

Stadia reductions. — Mr. Arthur Winslow presented, and described the derivation of, tables for stadia reductions, which furnish expressions for horizontal distances and differences of elevation, corresponding to 100-foot stadia readings for 2′ up to 30°, on the supposition that the rod be held vertically, and the stadia wires be equidistant from the centre wire. They are not mere reductions of inclined distances to their horizontal and vertical components, but embody certain corrections necessary from the facts, 1°, that with horizontal sights the length cut off by the stadia wires on the rod is not directly proportional to its distance from the centre of the instrument, but from a point at a distance in front of the object-glass equal to its principal focal length; and, 2°, that with inclined sights a correction has to be made for the oblique view of the rod. Both the distances and elevations in these tables are given in feet. They are adapted to use with a telescope whose object-glass has any focal length, and with a rod which is so graduated that the spaces cut off on it by the stadia wires are directly proportional to its distance from a point at a distance in front of the object-glass equal to its principal focal length, differing in these respects from the tables issued by the engineer department, U.S.A. — (*Eng. club Philad.; meeting* April 7.) [814

CHEMISTRY.

(*Organic.*)

Constitution of atropine. — A. Ladenburg proved that tropine is a tertiary base, since it would not unite with more than one molecule of ethyl iodide, and it was not affected by nitrous acid. By the action of chlorhydropasic acid upon it, a tropasate of tropine was formed; and, when treated with dilute hydrochloric acid, the latter substance was converted into atropine, which separated in beautiful crystals on evaporating the solution.

This product proved to be identical, in its chemical as well as in its physiological characters, with natural atropine prepared from belladonna. A series of derivatives, called by the author *tropeines*, results from the action of various organic acids with hydrochloric acid upon tropine. To establish the constitution of tropasic acid, it was prepared by the action of potassic cyanide in alcoholic solution upon chloracetophenon, and treating the product with baric hydrate. The resulting atrolactinic (or tropasic) acid was also made from hydropasic, and it was converted into atropasic acid. Since, furthermore, atropasic was converted into tropasic acid, the formula of the latter must be $C_6H_5CH{\scriptstyle\begin{matrix}CH_2OH\\COOH\end{matrix}}$. When distilled with soda-lime, tropine is decomposed, giving methylamine and tropilidine (C_7H_8); and, when treated with fuming hydrochloric acid, a volatile base, tropidine ($C_8H_{13}N$), is formed. By the action of hydriodic acid and red phosphorus, hydrotropine iodide ($C_8H_{17}NI$) results. Tropine is thus shown to contain an hydroxyl group; and the above-mentioned synthesis of atropine, and the formation of the tropeines, are explained: —

$C_8H_{14}NOH$	$C_8H_{14}NO(C_9H_9O_2)$	$C_8H_{14}NO(C_8H_7O_2)$
Tropine.	Atropine.	Homatropine.

The tropeines are therefore ethers of tropine, which is a nitrogen-containing alcohol. When heated with bromine, tropidine is decomposed, with the formation of ethylen bromide and dibrompyridine ($C_4H_5Br_2N$). The author is at present engaged upon the synthesis of tropine from pyridine. — (*Ann. chem.*, ccxvii. 74.) C. F. M. [815

Protocattannic acid and anhydrides of the aromatic oxy-acids. — Hugo Schiff states, that, when protocatechuic acid in aqueous solution is boiled with arsenic acid, a substance is formed, with the formula of diprotocatechuic, or protocattannic acid ($2\ C_7H_6O_4 - H_2O = C_{14}H_{10}O_7$). The solution possesses the general reactions characteristic of tannin; and mineral acids reprecipitate protocatechuic acid. When protocatechuic acid in etherial solution is acted upon by phosphorous oxychloride, tetraprotocatechuic acid is formed ($4\ C_7H_6O_4 - 3\ H_2O = C_{28}H_{18}O_{13}$). The solution fluoresces, and its reactions in general are characteristic of tannin. If an intimate mixture of protocatechuic acid and dry arsenic acid is heated to 160°, a catelagic acid corresponding to elagic is produced ($2\ C_7H_6O_4 - (H_2O + H_2) = C_{14}H_{10}O_7$). — (*Gaz. chim. ital.*, 1883, 90; *Berichte deutsch. chem. gesellsch.*, xv. 2588.) C. F. M. [816

Action of cyanogen chloride on pyrrol-potassium. — By the action of dry gaseous cyanogen chloride on pyrrol-potassium, Ciamician and Dennstedt find that the cyanogen molecule is introduced, forming cyanpyrrol or *tetrolcyanamide*. This substance polymerizes at the point of fusion, with the formation, probably, of tetrolcyanuramide or tetrolmelamine,

$3(C_6H_4N_2)$. The latter substance is not attacked by hydrochloric or nitric acid, nor by aqueous potassic hydrate. Sulphuric acid produces a brown color, which changes to black when the substance dissolves. Boiling alcoholic potassic hydrate gives pyrrol and an acid, probably cyanuric. Tetrolcyanuramide is analogous in structure to diphenylcyanamide, —

$CN - N = C_4H_4$	$CN - N = (C_6H_5)_2$
Tetrolcyanamide.	Diphenylcyanamide.

— (*Gaz. chim. ital.*, xxii. 102.) C. F. M. [817

METALLURGY.

Delta metal. — An alloy has been perfected by Mr. Alexander Dick of London, which is composed of copper, zinc, and iron. If ordinary wrought-iron is introduced into molten zinc, it will be taken up by the zinc to about five per cent of the quantity of zinc. This product is then added to copper, or to copper and zinc, in the desired proportions. The resulting alloy is said to be as much superior to brass as phosphor-bronze is to gun-metal. It has great strength and toughness. When cast in sand, its tensile strength is 21 to 22 tons per square inch. When drawn into wire of 22 W. G., its tensile strength is 62 tons to the square inch. — (*Iron*, Feb. 23.) R. H. R. [818

Metallurgy of the Incas. — At the meeting of the French academy on Feb. 6, M. Boussingault exhibited a bronze chisel harder than copper, but not so hard as iron, which was composed of 95 per cent copper, 4.5 per cent of tin, with traces of lead and silver. This tool is of a period previous to the conquest of the Incas by Spain. — (*Iron*, March 16.) R. H. R. [819

Soaking-pits. — At the meeting of the Society of engineers, Feb. 5, Mr. Church, in his inaugural address, referred to the device of Mr. John Gjers, which consists in placing ingots of steel directly in so-called soaking-pits. The ingot being thus surrounded by hot walls, the surface-heat is increased, and it is rolled by its own initial heat. This not only saves fuel, but avoids all danger of burning in reheating.— (*Iron*, Feb. 9.) R. H. R. [820

Equalizers. — The Pittsburg steel-casting company places the ingots in square-shaped pits of fire-brick, six feet deep, three feet six inches square at the top, three feet at the bottom. On each side of the row of holes is a pair of Siemens regenerators for gas and air. The holes are heated to 2,000° F., and are filled with gas as a non-oxidizing atmosphere; and four ingots, weighing about a ton, are placed in each pit. The ingots being dark red or medium red outside and fluid inside, it is but a few minutes before they are equalized to a soft yellow, and are then in the best condition to roll to small billets, or to flanged rails. — (*Iron*, March 2.) R. H. R. [821

AGRICULTURE.

Materials for manuring moors. — A paper by Fleischer describes the utilization of the sewage and garbage of the cities of Groningen and part of Bremen, for the reclamation and manuring of the surrounding moors. The materials are made into a compost, said to be comparatively inoffensive, and shown by analysis to have considerable value as manure, and sold, to be transported by water to the place of use. The paper is specially interesting in its bearings on the question of the utilization of city sewage. — (*Landw. jahrb.*, xii. 203.) H. P. A. [822

Sewage irrigation. — Gersen discusses at considerable length the various systems of sewage irrigation, and the reasons of their failures, and proposes a new method, in which the sewage is distributed over the surface to be irrigated in underground iron pipes under pressure, from which it is distributed by means of portable pipes. The ground may be flowed, or the sewage may be sprinkled upon it in regulated quantities. No levelling, and but little preparation of the surface, is required, and all open ditches or settling-basins are avoided. — (*Landw. jahrb.*, xii. 227.) H. P. A. [823

Determination of available phosphoric acid. — Ollech and Tollens have continued the experiments by Grupe and Tollens on the use of citric acid as a reagent for the determination of available phosphoric acid. They recommend the use of a 1½-per-cent solution of citric acid, 5 grams of phosphate, and 500 cc. water, and show that the phosphoric acid in the resulting solution can be precipitated directly with molybdic solution. — (*Journ. landw.*, xxx. 519.) H. P. A. [824

'Reversion' of superphosphates. — According to Post, the process of reversion takes place as follows: the free phosphoric acid acts first on undissolved tricalcic phosphate, forming monocalcic phosphate, and on iron and alumina, forming phosphates soluble in ammonium citrate. Later a double phosphate of iron and calcium or aluminum and calcium is formed, which is insoluble in ammonium-citrate solution. — (*Journ. landw.*, xxx. 573.) H. P. A. [825

GEOLOGY.

Cape Hatteras. — Professor W. C. Kerr's studies in North Carolina have led to some interesting conclusions in regard to the geologic history of Cape Hatteras. The modern cape is a tract of low land which is, on one hand, losing altitude by subsidence, and, on the other, gaining it by accretion. The accretion is three-fold: first, sediment from local rivers; second, vegetable accumulation in a system of peat-forming swamps which occupy the divides between the streams; third, shore-drift, brought by the waves and currents of the Atlantic from the north and south. The shore-drift is derived from the sediment of the Susquehanna and other rivers, and is deposited in a continuous bank of sand, constituting the sea-front of the cape. The wind throws it up in dunes, which slowly travel landward, and eventually help to fill the lagoon, or sound, caused by the subsidence.

The history of the coast has not always been characterized by subsidence; for at various levels there are lines of shore-dunes and other coast features, which could have attained their present position only by an elevatory movement. One of the best preserved coast-lines has an altitude of less than 20 feet, and another, referred to the glacial epoch, lies at 500 feet.

When the ocean stood at the 20-foot level, the angle of the continental coast was at Cape Lookout, and before that it was at Cape Fear; but, though these great changes in the outline of the coast have occurred in very recent geologic times, the cape itself, considered as a salient of the continental margin, is not a modern phenomenon. It is at least as old as the cretaceous; and since it is an accretionary growth, dependent now on a certain combination of prevailing winds and currents, it affords presumptive evidence that a similar combination has characterized this part of the Atlantic for several geologic periods. — (*Phil. soc. Wash.*, *meeting* April 7.) [826

Lithology.

The Lizard schists and serpentines. — Considerable study has been given to the Lizard district of Cornwall, during recent years, by Prof. T. G. Bonney, who seems now to be the best English petrogra-

pher. In the present paper he divides the schistose rocks into micaceous, hornblendic, and granulitic; and the microscopic characters of each group are given in detail. He endeavors to show the relation of the schistose rocks to the adjacent argillites, with which they have been supposed to be continuous. In the argillite he found a few fragments of the hornblendic rock, together with some felspathic fragments, which, he says, came from a metamorphic series. At another locality he found a fault (?) between the hornblendic rock and the argillite, at which the latter had been greatly broken. He states that the hornblendic rock here resembles a greenstone. but thinks he found in it signs of foliation and bedding. From this evidence he draws the conclusions that the argillites are younger than the metamorphic rocks 'by an enormous interval of time,' and that, while the former are devonian or older, the latter are azoic (archean).

Without objecting at all to his conclusions, one may point out the requirements to prove them, which he has failed to give. He has not proved the schistose series to be sedimentary, but admits that part may be eruptive, and that some of the series, at least, may be formed from volcanic ash. Until the series is proved to be sedimentary, the finding of supposed fragments of it in the argillites is no proof of difference in age; for eruptive materials are always apt to be embedded in the rocks forming at the locality at the time of the eruption. Bonney has further taken foliation as bedding, with which it may or may not correspond, and assumes that a metamorphic is synonymous with a sedimentary rock, when in reality eruptive, especially basic, rocks are more easily metamorphosed than most sedimentary ones; and the former make a large part of the so-called 'metamorphic rocks' in many regions of crystalline schists. Until Bonney gives evidence to prove that his series is sedimentary, his conclusions cannot be regarded as established merely because he considers the rocks sedimentary.

The serpentine rocks of the Lizard district had been discussed in a previous paper, but additional material is given here. Bonney holds that the serpentine is formed from the alteration of an eruptive peridotite. That serpentine is formed by the direct conversion of olivine rocks has been conclusively shown by the work of numerous lithologists; and, in this particular case, Bonney's microscopic observations bear out the general conclusion. That the Lizard peridotite was eruptive was shown by its forming dikes in the adjacent rocks, by its distorting and displacing them, and by its enclosing fragments of them. — (*Quart. journ. geol. soc.*, 1883, 1.) M. E. W. [827

METEOROLOGY.

Thermometer-shelters. — There have recently been worked up and published the results of experiments, on a large scale, which were undertaken in 1869, by the Royal society of London, for the purpose of testing various thermometer-shelters. The experiments were made in a large open field at Strathfield Turgiss. Ten varieties of shelters were tried, eight of these being open, and two (Stevenson's and the Kew pattern) closed. It was found that all the open stands were subject to serious objections, as they gave varying results in different weathers. On the whole, the closed shelters were regarded as the better; and Stevenson's was preferred to the Kew, as the smaller and more easily handled. It is still thought, that, in dull weather, and for hygrometrical observations, this screen has not sufficient ventilation for the most accurate results. All the screens gave nearly uniform results for the mean temperature. Experiments are now in progress for comparing wooden with Wild's metallic shelters. — (*English quart. weath. rep.*, 1879.) H. A. H. [828

Terrestrial radiation. — Professor Tyndall placed a thermometer upon cotton-wool which lay on the ground, and suspended another four feet above it. On Nov. 11, 1882, at 6 P.M., the readings were: wool, 26° F.; air, 36°. There was nearly a dead calm, — sky clear, and stars shining. The observations were repeated on Dec. 10, when, at 8.20 A.M., wool read 12°, and air 27°, with a clear sky, and very light wind. In both instances snow covered the ground. On many other days readings were made, and several of these with the sky perfectly clear, and with no visible impediment to terrestrial radiation; yet not one-fourth of the difference was observed that occurred on Dec. 10. Prof. Tyndall seeks to explain these results by the hypothesis, long since advanced by him, that the invisible aqueous vapor of the atmosphere in the latter cases interposes an effectual barrier to radiation, and hence the difference. It would seem as though a few observations of the amount of vapor would have assisted in establishing or overthrowing this supposition.

In a later number Prof. Woeikof discusses these observations, and suggests that the snow had a marked effect in reducing the temperature of the air just above it. He thinks that aqueous vapor has only a slight effect in checking radiation; not, however, in its gaseous state, but when condensed in small ice-crystals or water-droplets, even if, which is sometimes the case, it is invisible to the eye. He also suggests, that, in order to determine the real effect of aqueous vapor in terrestrial radiation, observations should be conducted in a climate, where, with a relatively great tension of vapor, the relative humidity is so small that there is no dew on clear nights, or, at least, it appears very late. Three thermometers, on cotton-wool, should be placed, one on the ground, and the others at heights from ten to a hundred feet above. If Prof. Tyndall's views be correct, the highest thermometer should show the lowest reading, as the aqueous vapor would impede radiation least from that one. He thinks there would be very little difference between the three thermometers. The matter is certainly worthy of careful experiment. — (*Nature*, Feb. 15, March 15.) H. A. H. [829

PHYSICAL GEOGRAPHY.

Effects of deforesting in the Alps. — P. Demontzey describes, in a very well illustrated article, the injurious results following the cutting down of forests in the French Alps; these being chiefly the washing of great quantities of detritus down from the slopes, the rapid formation of gulleys and ravines, especially in the softer formations, and the inundation of good valley-land with sand and gravel. The extension of the torrential cone of the Rioubourdoux (Basses Alpes), where the mountain stream enters a broad valley, and several deep ravines, formed since 1830, on the branches of the Bourget, are excellently shown. The remedy adopted against further growth of the gulleys is to build numerous small dams across the side streams, and thus force the waters to drop their sediments, and build up their channels, instead of deepening them. Planting trees is to go on with this as fast as possible, to prevent the wearing of the bare hillsides. — (*La Nature*, 1882, 151, 183, 215.) W. M. D. [830

Glacial erosion and lakes. — Rev. A. Irving has recently read two papers before the London geological society, — On the mechanics of glaciers, with special reference to their supposed power of excavation,

and On the origin of valley lakes, with especial reference to the lakes of the northern Alps, — coming to the conclusion that glaciers have not, and can not, cut out deep lake basins, although they may effect considerable general surface-erosion. Differential motions within the ice are regarded as consuming nearly all the gravitative and other force applied to the mass; so that an effective erosive motion of ice on bed-rock is small, and especially so in hollows where the motion is much retarded. The ice rather than the rock will yield when a stone is held between the two. Much rock-flour, washed away by the subglacial streams, may come from material carried down from surface-moraines. The author denies the force of Ramsay's argument that certain lakes cannot be explained save by ice-action, and thinks that certain possible causes were not sufficiently considered. Many alpine lakes are not at all where they should be, if formed by glaciers; and among the causes that may aid their formation are subsidence from underground solution, which recalls Playfair's old suggestion to account for Lake Geneva. This may be further aided by the simple weight of the ancient ice aiding to break down such undermined districts. Dislocations and folds, moraines, land-slides, and diluvial barriers, are also considered. Several special cases are referred to with some detail. — (*Quart. journ. geol. soc.*, 1883, 62, 73.) W. M. D. [831

Changes in the Mediterranean climate. — Dr. Th. Fischer, already known for his original studies in this direction, presents a brief statement of further work as supplementary to Tchihatcheff's entertaining lecture before the British association last August (v. *Proc. roy. geogr. soc.*, 1882). His argument is based on the decline of population, shown by the numerous ruins in now desert regions of the northern Sahara, as well as in Asia Minor and farther east; on the barrenness of districts formerly cultivated, as is shown by the remains of irrigation-dams stretching across dry river-channels (*wadis*); on the occurrence in the Algerian desert of flint chippings covered by a thin gypsum layer, evidently the deposit of a spring, though the region is now wholly dry; and on the frequent occurrence of lightning-tubes in the dry sands, implying former frequent thunder-storms. In Algeria, the recorded annual rainfall from 1838 to 1849 averaged 800 mm.; from 1850 to 1862, 770 mm.; from 1863 to 1876, only 639 mm. The deforesting of the country is regarded as having aided this decrease. Furthermore, the absence of camels from old monuments in Egypt, the former occurrence of elephants in the northern Sahara, and use of horses and oxen in crossing the now desert region, — all bear witness to the same general decrease of rainfall. — (*Peterm. mitth.*, 1883, 1.) W. M. D. [832

GEOGRAPHY.

(*Arctic.*)

Aboriginal population of northern America. — A recently issued report on the Indians of the Dominion of Canada, together with the information collected by the tenth census of the United States relating to Alaska, affords the means of approximating to the aboriginal population of that part of North America, north of the boundary-line of the United States, as it existed in 1860. The Indian population of British Columbia, Manitoba (including the Northwest Territory), Athabaska, and Rupert's Land, being the regions where governmental supervision is nonexistent or comparatively recent, is put at 78,264. Athabaska and Rupert's Land contain about 6,000, the remainder being nearly equally divided between the other two districts. In the older provinces, where the whites and aborigines have long been in contact, there are 32,241 Indians. Ontario has 17,126; Quebec, 11,089; Nova Scotia, New Brunswick, and Prince Edward's Island divide the remainder. There is an increase, in the total number, of 2,783 over that of last year. There are, of the total Indian population, 81,634 reported as living on reservations or under supervision.

In south-eastern Alaska, 6,725 Indians are reported; Cook's Inlet, Kadiak, and Prince William Sound are estimated to contain 1,028. The Kuskokwim valley is alloted 147; and the Yukon basin, 2,226. These latter figures are probably under-estimates; but the total arrived at is 10,126.

Of the Orarian or Eskimo population of the shores of arctic British America no enumeration is yet possible. From Labrador to the Mackenzie mouth, probably not less than 6,000 are scattered in various localities. In Alaska there are 2,214 Aleuts. Of Innuit, properly so-called, there are estimated to be 17,488, which is likely to prove excessive, and thus in the total to correct the supposed under-estimate of the Indian population. Of these, about 3,000 are assigned to the Arctic coast; about 2,000 to Cook's Inlet and Kadiak; 7,500 to Bristol Bay and the Kuskokwim delta; and 3,300 to the Yukon delta. Taken together, this would give 25,702 Orarians, and 120,631 Indians; or 146,333 aborigines for the whole area. As estimation enters into the figures in several places, it may be said in round numbers, that the region probably contains about 150,000 aboriginal inhabitants, or 1 to 65 □ kilometres. — W. H. D. [833

(*Asia.*)

Eastern Turkestan. — K. Himly's translation of the Si yü shui tao ki (Notes on the water-courses of the western district), a Chinese work written in 1824, is continued, but not yet concluded. The present number gives statistical description of the course and length of the Kyzyl, Yarkand, and other rivers, and numerous general and etymological notes. — (*Zeitschr. f. erdk. Berlin*, xvii. 401.) W. M. D. [834

BOTANY.

(*Physiological.*)

Holdfasts in Podostemaceae. — It is well known that the river-weeds possess organs by which they cling to loose stones much as Fuci do. Warming calls attention to the presence of root-hairs on these and many other kinds of holdfasts, and he proposes to bring the various sorts under a single designation, namely, Haptera. While the term may prove useful, it must be remembered that under it are comprised at least two unlike plant-members. As they fulfil the same office, namely, clinging, they are physiologically similar, although morphologically unlike. — (*Botan. zeit.*, March 22.) G. L. G. [835

Chemical constitution of certain protoplasmic bodies. — Zacharias, who has shown the curious chemical relations between the nucleus in plants and animals, and has pointed out the presence of phosphorus in the nuclei, has just given an interesting account of his studies in regard to the various contents of the cell in plants. Albumen, nuclein, and plastin are found in very different proportions in the different albuminoidal bodies in the cell. — (*Botan. zeit.*, March 30.) G. L. G. [836

(*Systematic.*)

Chapman's Flora. — The re-issue of Dr. Chapman's Flora of the southern United States, which has long been out of print, is accompanied by a supplement of seventy-four pages, giving all the addi-

tional species that have been detected since 1860, the date of original publication. These additions comprise 64 genera and 383 species, besides 46 species and 19 genera that are certainly introduced plants. Rather more than half of these species are from Florida. No changes of any kind are made in the original text, a revision of which must probably await the completion of the Flora of North America.—S. W. [837

Fern distribution in the United States.—The ferns of the United States now number 164 species (representing 32 genera), an increase of 39 in the last eight years. It is probable that the number is still by no means complete, and that others may be expected especially from the mountains bordering the Mexican boundary, and from the peninsula of Florida. Mr. Davenport gives a list of the known species, and their distribution among the states and territories. From his tables it appears that New York takes the lead in the number of species (52) that are credited to it, followed by California (48, with 4 others in doubt), Arizona (47, and 3 in doubt), Florida (47, and 2 doubtful), Michigan (47), Vermont (45), Pennsylvania (42, and 2 doubtful), Massachusetts (42), Kentucky (41, and 2 doubtful), Arkansas and Connecticut (41), etc. Six of the genera and twenty-four species are found only in Florida; one genus (Schizaea) is represented within the United States only in New Jersey; and, on the other hand, Pteris aquilina occurs in at least thirty-nine, and Asplenium Trichomanes and Adiantum pedatum in thirty-five out of the forty-eight states and territories. —(*Journ. Amer. phil. soc.*, Feb., 1883.) S. W. [838

Araceae.—Dr. Engler continues his contributions supplementary to his monograph of the Araceae in De Candolle's Monographia, proposing two new monotypic genera,—Synandrospadix, from the Argentine Republic; and Oligogynium, from tropical Africa. He approves of Baillon's adoption of Richardia as the older name of the Rubiaceous genus now generally known as Richardsonia, and follows him in the consequent restoration of Sprengel's name, Zantedeschia, for the 'Calla lily' (Richardia Aethiopica) and its congeners.—(*Engler's bot. iahrb.*, March, 1883.) S. W. [839

(*Fossil plants.*)

Relations of Lepidodendron, Sigillaria, and Stigmaria.—A new memoir by M. Renault answers the critical remarks of Prof. Williamson and Dr. Hartog of Manchester, against the conclusions reached in his *Cours de botanique fossile* (see p. 397). The English anatomists find no marked difference in the composition of the wood of Sigillaria and Lepidodendron, which is, in both, of a single centripetal zone of tissue. Both are, therefore, true lycopodiaceous or cryptogamous plants. M. Renault considers the wood of Sigillaria as composed of two distinct zones;—an internal, of centripetal growth; an external, centrifugal, with distinct agglomeration of tracheae of the woody cords of the leaves,—centripetal in traversing the inner zone of the wood, centrifugal in passing through the secondary, which covers the trachean mass. This double woody zone relates Sigillaria to the Cycadeae or to the dicotyledonous gymnosperms. This last opinion has been already sustained by Brongniart.—(*Consid. rapp. Lepid. Sigill. et Stigm.*, Paris, *Masson*, 1883.) L. L. [840

Tertiary flora of Australia.—From observations made at Dalton, New South Wales (eocene horizon), and in the Travertine of Hobart Town, Tasmania (miocene), Baron von Ettingshausen finds that the tertiary flora of Australia is far more nearly allied to the tertiary floras of the other continents than to the living flora of Australia. It appears not improbable, therefore, that the numerous forms which characterize the latter have been developed out of pliocene or post-tertiary forms of plants, thus far unknown to geologists. The existence at the present time of characteristic non-Australian genera in the flora of the continent is traced back to the tertiary period, in whose deposits remains of such forms as Fagus, Tabernaemontana, and Elaeocarpus, have been discovered.—(*Geol. mag.*, April, 1883.) A. H. [841

ZOÖLOGY.

Protozoa.

Development of Volvox.—Miss S. G. Foulke presented a communication upon the development of Volvox globator and its separated gonidia or reproductive spores. It was stated that in one case some of the gonidia freed themselves from the protoplasmic envelope, breaking the connecting filaments, and swam away. In some instances these free gonidia passed into an encysted state; in others, attached themselves by the remains of the filament to other substances, thus using it as a footstalk, and presented the appearance of Vorticella. Many of the free gonidia remained in a free swimming state. Others remained in the Volvox, developed in Amoebae, and emerged, after enveloping and digesting some of the neighboring gonidia. These Amoebae afterwards took the form of Amoeba radiosa, and then returned to their former state, seeming to have the power of using either shape at pleasure. As the parent Volvox belongs to the microscopic Algae, or water-plants, the change of its spores to a form in all respects apparently identical with an animalcule furnishes another interesting illustration of the approximation of the lowest animal and vegetable organisms.—(*Acad. nat. sc. Philad.; meeting* Feb. 20.) [842

Dimorphism in fossil Foraminifera.—MM. Schlumberger and Munier-Chalmas find that certain foraminiferal forms—otherwise undistinguishable from each other, except in the matter of size, and therefore specifically identical, as far as external characters alone would indicate—exhibit in the disposition of the central chambers some well-marked differences of structure, hitherto recognized as being of specific or even subgeneric value, but which appear to be entirely dependent upon the ages of the individuals concerned. In young individuals, as indicated by tests of small size, a relatively very large central initial chamber is distinctly visible; whereas, in the older or larger specimens, this chamber can only be determined by means of a powerful magnifier. This so-called dimorphism was found to obtain in both the perforate and imperforate groups,—in Nummulina, Assilina, Biloculina, Dillina, Fabularia, Lacazina, Triloculina, Trillina, Quinqueloculina, Pantallina, Heterillina.—(*Rev. scient.*, March 31.) A. H. [843

Worms.

Anatomy of Terebellides.—The anatomy and histology of T. Stroemii M. Sars has been investigated by Steen at Kiel. The drawings on the three plates are too schematic in character to inspire absolute confidence. The published article takes the form of a complete monograph, but consists substantially of a detailed description of the external form and appendages, and of the internal anatomy and histology. The various organs are taken up in succession, and excellently treated; but the details are hardly adapted for a brief abstract, although they will be valuable in compiling a comparative histology. —(*Jena. zeitschr. naturw.*, xvi. 201.) C. S. M. [844

Multiplication of worms by division. — Dr. C. Bülow has investigated the processes of transverse division in Lumbriculus variegatus, and the regeneration of parts to complete a new individual out of the pieces of the parent body. His article is prefaced by a valuable *résumé* of previous investigations. In Lumbriculus, besides the sexual there is a natural asexual propagation, by simple transverse division, occurring spontaneously. Head and tail, both or either, can be re-formed. There is no budding zone formed before division: the process is therefore different from that in Nais and the Syllidae. In both head and tail the segments are apparently newly developed from before backwards (*contra* Bonnet). The head and tail buds are formed within 48 hours after division; and, in a few days, defecation through the new tail-end may be observed. The re-development may be produced by artificial division. One individual was cut into fourteen pieces, of which thirteen grew up to complete individuals. (The paper would have been improved by much shortening and more careful arrangement.) — (*Arch. für. naturgesch.*, 1883, 1.) C. S. M. [845

Anatomy of Prorhynchus. — J. von Kennel publishes an article on Prorhynchus, one of those doubtful genera of worms whose systematic position could not hitherto be satisfactorily determined. Kennel shows definitely that it is a rhabdocoelus turbellarian. It has a simple straight intestine, and muscular pharynx. The structure of the integument and parenchyma of the body is like that in other Rhabdocoela, and not like that of nemerteans. The same may be said of the nervous system. The penis lies well forward, and, before its structure and relations were correctly understood, was compared to the proboscis of nemerteans, with which it has no relation. It is armed with a spine, and has a muscular bulb at its base, which is connected by a somewhat tortuous duct with the vesicula, in which the products of the male glands are directly received. It lies ventrally from the pharynx. The stylet is exserted through the mouth. It is a very complicated apparatus, which the author fully describes. There are no separate yolk-glands; but these are united (unlike other plathelminths) in one mass with the ovary. This is the most important difference found between Prorhynchus and other Rhabdocoela. — (*Semper's arbeiten*, vi. 69.) C. S. M. [846

VERTEBRATES.

Equilibration functions of the semicircular canals. — From observations on dogs with one or both auditory nerves divided, Bechterew concludes: 1°. Unilateral section is followed by forced movements of rotation around the long axis of the body, with deviation of the eyes, nystagmus, etc. 2°. The movements, at first constant, occur later in paroxysms separated by periods of rest. During the latter, the animal assumes a constrained position, lying on the opposite side to that of the section. Finally, the rolling movements altogether cease; but the animal has a tendency to exhibit circus movements towards the injured side, and has a deficient power of maintaining its balance on its feet. 3°. All the above symptoms are reflex, since they are still exhibited after removal of the cerebral hemispheres, or in narcosis. They are, however, more marked when the hemispheres are present. 4°. Section of both auditory nerves is accompanied by marked deficiency of the power of maintaining equilibrium. The animal can neither stand nor walk. 5°. When only one nerve is cut, the forced movements are due to a disharmony resulting from the absence on one side of the normal semicircular-canal sensations, and their presence on the other. Hence the cerebellar equilibration-centres act abnormally; also, when the cerebrum is present, the uninjured side sends stimuli to the centres of consciousness, which, being unbalanced by the usual associated stimuli from the other side, lead to vertigo. 6°. The well-known action of auditory impressions in influencing movements (as in dancing and marching) occurs, in all probability, through the semicircular canals. — (*Pflüg. archiv*, xxx. 312.) H. N. M. [847

Influence of the spleen on pancreatic digestion. — Twenty years ago Schiff published researches which led him to believe, that, after removal of the spleen, the pancreatic secretion lost its power of digesting proteids. His final conclusion was that, the spleen did not itself make the proteolytic ferment, but furnished to the blood something essential for its formation in the pancreas. Schiff's statement attracted but few adherents; and Haidenhain, in 1875, proved that a substance (zymogen) capable of yielding proteolytic ferment, accumulated in the pancreas quite independently of the presence or absence of the spleen. This seemed, at first sight, to completely overthrow Schiff's theory of the splenic function in digestion. Herzen now brings forward experiments which reconcile the apparently opposite conclusions. He claims that his researches on dogs prove that after removal of the spleen, the pancreas may still heap up zymogen (*trypsogen*), but that this is not under such circumstances transformed into a proteolytic ferment (*trypsin*), as it is normally when the spleen is present and in physiological activity. Hence, after splenotomy, or in cases of serious splenic disease, the digestion of albuminous substances is greatly impaired. — (*Pflüg. archiv*, xxx. 295.) H. N. M. [848

Mammals.

Early stages of the guinea-pig ovum. — Spee has published the results of his observations on this subject. Up to the beginning or middle of the fourth day, the ova remain in the oviduct, whence they must be carefully extracted. Eggs of two days have four segmentation-spheres, around and between which a coagulated mass soon appears *post mortem*. On the third day the limits of the cells are unrecognizable; but they may be more or less isolated by bursting the ovum. After the fifth day, the coagulum no longer appears around the segmentation-spheres. In all the early stages *post-mortem* changes are very great and rapid. While still free, after the fourth day, the ova lie in the tip of the uterus, whence they may be driven by forcing with a syringe a current of warm 0.5% salt solution into the vagina, and out of the tip of the uterus (after cutting off the oviduct). By employing this method, Spee has obtained germ-vesicles (keimblasen) agreeing essentially with corresponding stages as found in other mammalia, the principal difference being that the cells are relatively larger, segmentation not having progressed so far. There is an outer wall close against the zona pellucida, and composed of a single layer of cells, spindle shaped when seen in section, polygonal when viewed from the surface. At one pole is an accumulation of cells, the 'keimhügel,' while at the opposite pole the cells at the outer layer are thickened. In a later stage the cells of the latter pole are found to have thrown out branching processes which penetrate the zona pellucida. Apparently these processes increase in size; and it is probable that they make a hole through the zona by which the egg makes its exit. Spee has actually found, in one case,

an empty ruptured zona. This is an important and interesting observation, because the fate of the zona pellucida has not been hitherto determined. Spee adds the suggestion that possibly the same protoplasmic processes which serve to free the egg, also act to fasten it to the wall of the uterus.

As a continuation of Spee's paper, Hensen describes an ovum, soon after attachment to the uterine wall, found six days and twenty-three hours after copulation. The egg (0.13×0.08. mm. in diam.) lay in an open pit of the mucosa. It consists of a vesicle, with a mass of cells on one side, therefore agreeing in structure with the latest stage of the free ovum seen by Spee. Formerly Hensen considered the mass of cells to represent the ovum, and the wall of the vesicle to be an outgrowth of the epithelium of the uterus; but he now withdraws that interpretation, and accepts Schäfer's view that the whole is ovic. "The vesicle is therefore the single-layered primary chorion, which is derived from the ectoderm, and is separated very early from the embryo proper. In other mammals this separation does not occur until after the formation of the amnion." The ectodermal cells of the germ-mass of the embryo come to form a hollow, and this hollow Hensen homologizes with the amniotic cavity of other mammals. Of course, therefore, it is bounded by the ectoderm, and, beyond that, by the entoderm. The apparent reversal of the layers is therefore due to the early development and peculiar position of the amniotic cavity, inside the ovum. In conclusion, Hensen insists upon the importance of showing that the histological value of the germ-layers is really preserved, even in so unusual a form of development as that of the guinea-pig. — (*Arch. anat. physiol., anat. abth.*, 1883, 44, 61.) C. S. M. [849

Germ-layers and gastrula of the mouse. — In some rodents the germ-layers have apparently a position the reverse of that in other animals. This fact has led Selenka to investigate the early stages of white mice in the search for the explanation of the reversal. He has published a preliminary notice of his results. There is a special envelope of covering cells within which the cells of the embryo proper undergo their development. (This is perhaps the stage described by Spee — see 849 — in the guinea-pig, as a vesicle with a clump of cells at one end.) The embryo-cells lie at one end, separate into the two primitive layers, and become united with a support formed by a knob of cells attached to the uterine wall. This knob is not used in the construction of the embryo. The mass of ectoderm-cells becomes hollow, and the cavity increases in size. In the ectodermal cells limiting it, the ectodermal organs of the embryo are developed according to the typical processes in other mammalia. A more detailed report of this interesting research will be given when the full memoir is published. — (*Biol. centralbl.*, ii. 550.) C. S. M. [850

Embryology of mice. — The observations of Selenka and Kupffer on the development of mice have been critically reviewed by Hensen. He does not accept their views as to the gastrulation, or that the formation of the cavity bounded by the ectoderm is the gastrula development. Selenka attributes the reversal of the germ-layers to the proliferation of the ectoderm-cells; but Hensen maintains it to be due to the invagination of the mass of cells forming the embryo-germ. The ectodermal cavity in Arvicula does not correspond, as would seem natural, to the amniotic cavity of the guinea-pig; for an amnion is subsequently developed in its interior. (Does not this rather indicate that Hensen's homologizing the ectodermal cavity in the guinea-pig with the amniotic cavity is erroneous, and that it is really the same as the ectodermal cavity described by Selenka and Kupffer?) Finally Hensen discusses briefly the position of the germinal disk in guinea-pigs, and compares it with that of rabbits. — (*Arch. anat. physiol., anat. abth.*, 1883, 71.) C. S. M. [851

ANTHROPOLOGY.

The Onondaga Indians. — In 1882 the legislature of New York appointed three commissioners to inquire concerning the condition of the Onondaga Indians; and their report has been published. With the feud between the the christian and the pagan parties, we have nothing here to do; but much interesting ethnologic matter appears throughout the pamphlet. On the reservation in Onondaga County are 319 souls, who, with others of their tribe scattered through the state, amounting in all to 500, constitute a nation, recognized as such in treaties and by the courts, holding their lands in perpetuity, not to be sold or in any manner disposed of, and regulating them entirely after their own fashion. The origination of the union of the Six Nations is detailed in Morgan's League of the Iroquois, and a brief sketch of their history is given in the pamphlet now under review. The Onondagas hold their land in common; but certain portions are held by individuals, and these possessions are bought and sold and leased to one another. Some of them are thrifty farmers, owning cattle, oxen, and horses, and they frequently monopolize the best lands. The old custom of frequent divorces has been partly broken up by the new constitution of the tribe; and the law now conforms to that of New York respecting the Indians, — that those who contract marriage shall be considered as lawful husband and wife, and their children shall be legitimate. In practice, however, there is just ground of complaint. The evidence before the commission shows that old practices are kept up in some of the Indian dances that are incompatible with civilization. To the report of the commission are appended the new constitution, and the complaints and charges of the two factions in the tribe. — J. W. P. [852

Philologic science. — Dr. Frederick Müller, of Vienna, published, during the past year, parts 1 and 2 of vol. ii. of his *Grundriss der sprachwissenschaft*, devoted to the languages of the smooth-haired races. Part 1 is devoted to the Australians, the Hyperboreans, and the Americans; part 2, to the Malays and the northern Asiatic (Mongolian) races. Of the subdivisions of the Australian race, it is impossible here to speak. The Hyperboreans are made to embrace the Yenisei-Ostjaks, Yukagirs, Chukchis, Ainos, Aleuts, and Innuits. The American languages discussed are the Athapaskan, Algonkin, Iroquois, Dakotan, Cherokee, Chahta, Kolosh, Selish, Sahaptin, Chinuk, Mutsun, Nahuatl, Sonoran, Otomi, Taraskan, Tototen, Matlatsinka, Mixtek, Zapotek, Maya, Mosquito, Bribri, Arowak, and Carib, in North America; and the Moxos, Muisca, Paeses, Yaruros, Chimu, Inca, Guarani, Kiriri, Chiquitos, Lules, Abipones, Moluches, and Tehuelche, in South America.

Under the high Asian languages in part 2, Prof. Müller includes the Samoyede, Ural-Altaic, Japanese, Corean, Tibetan, Burman, Siamese, Khasian, Anamese, and Chinese.

In no case does the list of languages claim to be exhaustive; and especially is this true of North America. The plan with each tongue is to commence with the sound system, and, proceeding from a discussion of root-forms, to progress through the differentiation

of parts of speech and accidence, so far as this has taken place. [853

Nomenclature of stature. — Dr. R. Fletcher read a note on Zoja's scheme for nomenclature, relative to human stature, of which the following table presents the main features: —

			Centimetres.
Gigantosoma	Hypergigantosoma.	Phenomenal . .	251– supra.
	Gigantosoma. . .	Giants	226–250
	Hypogigantosoma .	Gigantic . . .	201–225
Megasoma	Hypermegasoma .	Near gigantic .	191–200
	Megasoma . . .	Very tall . . .	181–190
	Hypomegasoma .	Tall	171–180
Mesosoma	Hypermesosoma .	Above ordinary.	166–170
	Mesosoma. . . .	Medium . . .	165
	Hypomesosoma. .	Below ordinary.	164–160
Microsoma	Hypermicrosoma .	Low	159–150
	Microsoma . . .	Very low. . .	149–140
	Hypomicrosoma .	Lowest normals.	139–125
Nanosoma	Hypernanosoma .	Dwarfish . . .	124–100
	Nanosoma . . .	Absolute dwarf.	99–75
	Hyponanosoma . .	Phenomenal . .	74 et infra.

The observation was made, that the figures given are for Italians, and would have to be modified for each race of men. — (*Anthrop. soc. Wash.; meeting* April 17.) J. W. P. [854

Through Siberia. — This is the title of a work by Henry Lansdell, first appearing in 1881, and issuing in a third edition, in 1882, by Houghton, Mifflin, & Co., Boston. The author's journey was overland through Tobolsk, Tomsk, and the southern part of Siberia, across the head waters of the great north-flowing river-systems of Asiatic Russia, to the mouth of the Amoor River. The chief motive of the trip was a study of prison-life in the countries visited; but works of this kind frequently reveal delicate flowers of aboriginal life and facts that are as welcome to the reader as their great value is unappreciated by the writer. The author gives a list of the stocks mentioned in the Russian map of this territory, as follows: Slavs, Zeryani, Voguls, Votyaks, Tatars, Kirghees, Karakalpaks, Sarto, Usbeks, Turks, Kalmuks, Teleuti, Ostjaks, Samoyedes, Yurakis, Yakuts, Tunguses, Goldi, Gilyaks, Yukagirs, Chukchis, Koriaks, Kamchadales, Ainos, Buriats, Manchus, and Chinese. The manner in which the ethnological information is scattered through the work renders it difficult to refer to that concerning any one tribe. Especial interest will be taken in the mention, on p. 26, of the Tatars, descendants of the followers of Genghis Khan. The ethnography of the Ob-Irtish valley, including Tatars, Russians, Voguls, Ostjaks, and Samoyedes, will be found on pp. 98–106, 124–126; that of the Yenisei, on pp. 205–210; that of the Yakutsk province, on pp. 296–308, with a short vocabulary on p. 305. In chapter xxviii. will be found an account of personal adventures with the Mongolian frontier races; and in chapter xxx., a description of the Burjats. Coming to the Amoor River, the Oronchons, or reindeer Tunguses, and the Manyargs, or horse Tunguses, meet the traveller (see pp. 507–511). Chapter xliii. introduces us to Manchuria and its inhabitants; and chapter xlvi., to the Gilyaks and Goldi at the mouth of the Amoor; and the closing portion, to eastern Siberia, the Kamchatkals, and Sauhalins. The volume closes with a bibliography and a copious index. — J. W. P. [855

EGYPTOLOGY.

Art in Egypt. — The influence of the earlier art of Chaldea and Assyria on art in Egypt, is the subject of a work by L. von Sybel, Kritik des aegyptischen ornaments (Marburg, 1883), in which he takes the position, that, after the eighteenth and nineteenth dynasties, the art of Egypt was largely modified by the influence of Chaldean and Assyrian art. This, he asserts, is shown not only in decoration, but also in statuary of the human form. Perrot, though differing in some respects from the author, bears witness to his extended researches and his excellent taste. — (*Rev. archéol.*, Dec., 1882.) H. O. [856

Color in Egypt. — "Egyptian color must be seen in Egyptian sunlight, which almost blots it out, or in the dim interior of an Egyptian temple, and then the strong contrasts of bright hues are very much sweeter and more musical than they seem to us. There is a gentle harmony in them. . . . It is impossible, without seeing a very fine Epyptian monument under the conditions of light in which the builders meant it to be seen, for us to apprehend their coloring, which certainly, when represented in pictures, or seen in our own generally diffused light, has an aspect of harshness, though the harmony of color is maintained in the use the Egyptians make of it. Take ivory and ebony, gold, lapis lazuli, green and red jasper, and let a great master make a mosaic in Egyptian style, and you would see how really grand it is, and how it has in it that large simplicity which connects it with the expression of durability. I think if you will study Egyptian decoration you will find this to be true." — (R. S. Poole, *in* '*Lect. on art*,' 1883.) H. O. [857

EARLY INSTITUTIONS.

Institutions of early Rome. — M. Alfred Maury sums up the conclusions of Gen. Favé in his *Ancienne Rom* (Paris, 1880, 8°). The city presents itself at first as an aristocracy of free men (*ingenui*) governed by the heads of families (*patres*). It was an aristocracy of landlords and warriors. Below this aristocracy were the plebeians, who were clients of the patricians; at any rate, subject to them, and governed by them. Most of the land was in the hands of the patricians. The plebeians appear to have had only movable property, and not much of that. As in the feudal time, during the middle ages, war was regarded as the school of virtue; but it was a school for every class of free men (which was not the case in feudal times). The freemen went to war at their own cost, each man spending his own money in it. The burden of military service was very heavy for the poorer classes of freemen, and it was a principal cause of the pauperism and indebtedness of the plebeians, of which we read so much. The people were continually called out to war, and had no time left them in which to provide themselves with the necessary means of support. The writer describes the institution of paid forces and standing armies. This gave to Rome a great advantage over the other states of Italy, where the people were still called to war at their individual cost. The result was, that not only Latium, but almost all Italy, was soon subject to Rome. Colonies of Roman citizens were then planted in various parts of Italy, and, what was unprecedented, garrisons of soldiers were established to protect them. The other states of Italy did not protect the colonies which went out from them. The colonies were frequently quite severed from the mother-state. This was not the case with the colonies of Rome. They were the outposts of a military system. The arts of war and defence were constantly cultivated by the Romans. This was not the case in the other states of Italy, and they were easily conquered. Gen. Favé considers the early history of Rome from the military point of view. — (*Journ. des sav.*, Jan., 1883.) D. W. R. [858

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Department of agriculture.

Facts of interest in economic entomology. — Bulletin 2 of the entomological division contains the following facts of interest: —

The Chrysomelid Graptodera carinata injured fuchsias by eating the leaves in September at Germantown, Penn. — During 1882 the army-worm was reported from Saratoga County, N.Y., at the north, to the Red-river valley in Louisiana, at the south. — The larva of Agrotis inermis is mentioned as cutting down smilax in an extensive flower-garden at Germantown, Penn. — The clover-leaf weevil (Phytonomus punctatus) was as destructive in Yates County, N.Y., in 1882 as in 1881; and its spread into adjoining counties was noticed. — Ephestia zeae was received from New-York City, with accounts of damage done by the larva to lozenges. — The description of the curious work of a mite allied to Tetranychus tellarius, found at Melrose Highlands, Mass., is given. A large ash-tree was almost entirely covered by a filmy web spun by this mite. — The little homopterous Entilia sinuata Fabr. was sent from Franklin Falls, N.H., as destroying the Canada thistle. — Isosoma tritici was received from Columbia County, Wash. Ter. — The fungus, Scorias spongiosa, upon the honey-dew of Schizoneura imbricator, was sent from Johnson County, Tenn. — Twigs of Wistaria were received from Hudson, O., which were bored by the larva of Elaphidion villosum. — A letter from Mr. H. G. Hubbard, on the aid of spiders in the spread of scale-insects, is given in full. — The seventeen-year cicada appeared in 1882 in parts of Yates, Ontario, Livingston, and Wyoming Counties, N.Y. — A mill at Lansing, Mich., was overrun (November, 1882) by the two beetles Palorus depressus and Laemophlaeus alternans. — The natives of Upper Birmah use, as a remedy for cotton insects, conjee-water; i.e., fermented rice-water, with a little salt and the rind of a fresh squeezed lemon thrown in. — Mr. William Plumer of Lexington, Mass., advises the addition of a small quantity of gum-arabic or glue and bichromate of potash to insecticide solutions, in order to render them 'water-proof,' or less readily washed off by rains from plants or trees to which they have been applied. — The effect of frost upon scale-insects is considered in a letter from Mr. Joseph Voyle, of Gainesville, Fla., who concludes, that, by unusually cold weather, larvae killed, but not enough to be of service to the hatching and development are retarded, and a few tree.

PUBLIC AND PRIVATE INSTITUTIONS.

Astronomical observatory of Harvard college, Cambridge, Mass.

The work at the observatory. — There has been great progress in the reduction and publication of past observations. The catalogue giving the results of photometric measurements on four thousand stars is now in the hands of the printer.

Photometric observations of a hundred and eighty-five eclipses of Jupiter's satellites have been made. The search for objects with singular spectra has been continued and carried on with more system than formerly. At the last opposition of Mars, the satellites were seen, and photometric measurements were obtained which agreed with those made in 1877. The results of the photometric measurements of various points on the moon have been published in the *Selenographical journal*, v. 57. Mr. Chandler has made a careful study of Sawyer's variable star, and has found the period to be about twenty hours. The variation of the light is about three-fourths of a magnitude.

Profêssor Rogers has found it necessary to take a prolonged rest from night-work, but will resume soon. The results of his work in the last twelve years will occupy three volumes of the Annals, and are being prepared for publication.

The measurement of the light of the stars visible to the unaided eye was completed last summer. Over ninety thousand measures were made on about four thousand stars. The effect of atmospheric absorption has been found, for any altitude exceeding 15°, to equal in stellar magnitudes one-fourth of the secant of the zenith distance. This agrees with the result of Seidel, the average deviation of the two determinations not exceeding one-thirtieth of a magnitude. An extended comparison of the scale of magnitudes employed by previous observers has been made. A reduction of the observations of Sir William Herschel has been effected, and has led to important results. Their neglect hitherto has been partly owing to the want of a suitable system of magnitudes by which they might be reduced. This want has been supplied by the photometric measures at this observatory. We have thus an accurate measure of the brightness of a large part of the lucid stars of a hundred years ago.

NOTES AND NEWS.

The fifth session of the congress of Americanists will be held in Copenhagen, Aug. 21–24, under the patronage of Christian IX., king of Denmark. Dr. J. J. A. Worsaae, director of the museum of ethnography, will be the president, and W. A. Carstensen, general secretary. A prospectus of the meeting has been published, and may be had from the president or the secretary. Any one remitting twelve francs to M. Tietgen, *directeur de la Banque privée de Copenhague*, will be entitled to a ticket of membership and a copy of the report. The subjects to be discussed are as follows: —

History and geology. — Discovery of America; The Northmen in Greenland; Mexican *calpullis;* Central American nationalities; Mexican and Peruvian military systems; The Popol Vuh; Comparison of the kingdoms of Cuzco, Trujillo, and Peru; Peruvian divinities, Viracocha, etc.; Migrations of the Caribs; Traditions of the deluge in America.

Archeology. — Kjökkenmöddings of Greenland and elsewhere; Sacred signs; Religious and emblematic significance of idols, etc.; Architecture of Peru.

Anthropology and ethnology. — Tribal synonymy and cartography; Kingdoms of Cibola, Quivira, and Tegnayo; Ethnology of New Granada and the Isthmus; North America and Central Asia compared.

Linguistics and paleography. — Grammar of the Eskimo compared with that of other American languages; Mexican languages and others compared; Decipherment of Maya inscriptions, and of quippos; Peruvian languages, and others compared.

— At the annual meeting of the Boston society of natural history, May 2, the following officers were chosen: president, Samuel H. Scudder; vice-presidents, John Cummings, F. W. Putnam; curator, Alpheus Hyatt; honorary secretary, S. L. Abbot, M.D.; secretary and librarian, Edward Burgess; treasurer, Charles W. Scudder. The report of the curator, Prof. A. Hyatt, gave a full account of the mineralogical collection, the re-arrangement of which has just been completed, and to which we shall soon refer more particularly. It was shown that it would be impossible to complete the arrangement of the other collections in similar manner, without additional income at the society's disposal. Considerable work was done in the geological collection, but its final arrangement will need at least a year's more work.

The trustee of the Lowell lecture fund has generously continued to support the Teachers' school of science, in which ten lessons had been given by Prof. W. H. Niles, on physical geography, and five by Dr. H. P. Bowditch, on physiology. Both courses were attended by large numbers of teachers. Laboratory instruction was also given to one class from the Massachusetts institute of technology, and one from the Boston university, besides two private classes; and during the summer, instruction was given to fourteen students in the curator's laboratory at Annisquam, Mass. In one dredging-trip specimens of Octopus and other interesting forms were brought up from about forty fathoms.

The secretary reported the additions to the library to amount to 2,065 volumes and pamphlets. Three parts of the proceedings and three of the memoirs had been printed, together with a new list of members.

Seven essays were offered in competition for the Walker prize of the year, — 'The life-history of any animal.' The committee awarded the first prize to Howard Ayers of Cambridge, for his essay on the development of the tree-cricket (Oecanthus niveus) and one of its parasites (Teleas). The committee requested further time for the consideration of the award of the second prize. The successful essay fills a hundred and twenty-seven manuscript pages, and is beautifully illustrated with thirty plates carefully drawn and colored. The author has attempted to establish or discuss the following points: for Oecanthus; the origin of the ovum in a germarium, the process of yolk-formation by cell-degeneration instead of secretion, a primitive segmentation of the embryo before the appearance of the permanent segments, the existence of a pair of appendages on each of the seventeen segments, the formation of the dorsal vessel as originally a paired organ (as in some worms), the existence of embryonic gills, the lack of any sharp distinction between a cell and its nucleus and between the latter and the nucleolus, the origin and significance of the embryonic membranes, and the dorsal organ among insects; in Teleas; the absence of embryonic membranes, and the occurrence of an intermediate larval form between the blastosphere and the cyclops-larva of Ganin.

— At the close of its last session, Congress made provision for the co-operation of the United States in the researches proposed by the electrical congress at Paris in 1882. The secretary of state has designated as commissioners, on the part of this government, Professors Barker of the university of Pennsylvania, Trowbridge of Harvard university, and Rowland of Johns Hopkins university. The sum of $12,500 was appropriated for experiments.

— The newly organized Royal society of Canada will hold a session in the parliament buildings at Ottawa, commencing May 22. Delegates from several scientific bodies in the United States are expected to be present.

— At a meeting of the Washington anthropological society, April 17, Dr. W. J. Hoffman made a comparison of Eskimo and Californian pictographs by means of charts, by which he showed the relation between these figures and the sign-language of the North-American tribes. A wonderful familiarity with the gesture-speech enables Dr. Hoffman to read many of the pictographs with perfect readiness. Mr. J. Curtin, who has spent much time in diplomatic service in Russia and Hungary, and has brought home a rich treasure of the folk-lore of the regions in which he has travelled, read a paper on Scandinavian and Magyar folk-lore. Dr. Fletcher explained Zoja's scheme for the nomenclature of stature, given elsewhere in this issue.

— By the system of railway time recently recommended by the railway time convention in St. Louis, the time of the different long railways of the country would only differ by whole hours. It is proposed that each road shall reckon its time from one or more of a set of meridians fifteen degrees, or one hour, apart, so that the time of each meridian may reach seven and one-half degrees, or thirty minutes, on each side. The meridians suggested for the United States are the 75th, 90th, 105th, and 120th, west of Greenwich. The confusion of time now so common in many of our large cities would in this way be avoided, the minutes and seconds, at least, agreeing on the different roads.

— The treasurer of the Balfour fund acknowledges the following additional subscriptions: Prof. J. Playfair McMurrich, Ontario, $5; T. Mackenzie, University college, Toronto, $1; George Acheson, Collegiate institute, Toronto, $2; H. Pillsbury, High school, Springfield, Mass., $1; Prof. J. H. Comstock, Cornell university, $5; Prof. J. A. Holmes, University of North Carolina, $5; Prof. H. C. Coon, Alford university, $1. Previously acknowledged, $466.25.

— In SCIENCE, p. 338, in the article on Formation of the tails of comets, read, 'Mr. Ranyard suggests.'

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR OF SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

SCIENCE.

AN ILLUSTRATED JOURNAL, PUBLISHED WEEKLY.

OWNED BY THE SCIENCE COMPANY.

OFFICERS AND DIRECTORS.—D. C. GILMAN, of Baltimore, *President;* GARDINER G. HUBBARD, of Washington; ALEX. GRAHAM BELL, of Washington, *Vice-President;* OTHNIEL C. MARSH, of New Haven; SAMUEL H. SCUDDER, of Cambridge, *Treasurer.*

SUBSCRIPTIONS.—In United States and Canada, $5 a year.
In Great Britain and Europe, $6 a year.

MOSES KING, *Publisher*, CAMBRIDGE, MASS.

FRIDAY, MAY 18, 1883.

THE SOCIETY OF NATURALISTS OF THE EASTERN UNITED STATES.

IN answer to a call dated March 31, a number of working naturalists met at Springfield, Mass., April 10, to consider the advisability of organizing a society for the discussion of methods of natural history work. In the discussion which followed the election of Professor Hyatt to the chair, it was shown that every one present had often felt the need of opportunities to meet other workers in his own special field with whom to discuss such topics as methods of laboratory work; laboratory technique; new and valuable processes of staining, mounting, cutting, and preserving sections; different systems of instruction in various departments of natural science; methods with small elective classes, or with large college classes; the position which the sciences of observation should hold in the college curriculum; the amount of natural science which should appear in college entrance examinations; the amount and character of such instruction essential in preparatory schools; museum interests; mutual aid or co-operation between different museums; methods of museum work; methods of exhibition; and similar topics.

While there are many opportunities for the publication of the results of scientific work and investigation throughout the country, and for keeping up with current results, there has existed heretofore no association where such subjects as those above named could be made the chief topics of discussion. The need of an association devoted to such technical purposes is certainly as great at the present time, when science is beginning to take its proper place in the curriculum of all educational institutions, and laboratories and museums are springing up all over the country, as was the need in earlier days for founding the American association for the advancement of science. Published essays can be read at home; but for the right understanding of difficult manipulation in the laboratory, of methods of instruction either in the laboratory or class-room, or for any efficient co-operation, it is essential to meet and talk with the originator of the method, or with one who is well versed in its application. The worker in natural science knows that in every laboratory new points are being constantly developed, which, though of value for saving time or labor, are frequently never published.

At the meetings of this society there will be special opportunities for getting such information from a number of laboratories where work is constantly going forward. Again: the meetings will furnish chances for those at home to meet and question the many American naturalists, who, on their return from visiting or working in the best laboratories in England and Europe, bring with them the latest methods in vogue on the other side of the Atlantic, — a number which may increase, now that an American table at Döhrn's zoölogical station, Naples, is held by Williams college.

The work of organization occupied nearly all the time at the Springfield meeting; but, in the brief informal discussions which followed, the opinion was very generally expressed, that one of the most important questions with which we have to deal, and one which needs immediate attention, is the preparation necessary for the study of natural science in colleges. The great difficulty in making a success of college instruction in the sciences of observation lies in the fact that not one young man in twenty knows either how to observe, or how to think about facts of observation. His education in that line is very deficient, or else entirely wanting; he is utterly helpless without his books, and seems quite unable to see or to correlate facts for himself. No other branch of the curriculum is so inefficiently treated by the preparatory schools and academies. It is the reverse of right, that the college professor, with a class of from forty to eighty men, should have to make the vain attempt to teach the lowest step in the observational sciences. Methods which can alone guarantee success in imparting to the eye and the mind the rudiments of science cannot be employed under such conditions. Moreover, it is a matter for

the deepest regret, that young men who are soon to be in places in the world where they have no books, and where the keenest exercise of the powers of observation, and the judgment of facts are demanded, should in so many cases have no opportunity, or next to none, either in school or college, for the acquisition of a training upon which the success of their life-work, in the larger number of professions and occupations, is dependent.

It is to be hoped that one needs only to mention such objects as these, to bespeak for this new association the sympathy and support of all naturalists and earnest workers in science.

At the concluding session of the meeting just held, the society elected the following officers: president, Professor Alpheus Hyatt, curator of the Boston society natural history; vice-presidents, Prof. H. Newell Martin, Johns Hopkins university, Prof. A. S. Packard, jun., Brown university; treasurer, Prof. William B. Scott, Princeton college; secretary, Prof. Samuel F. Clarke, Williams college.

At the same session, a constitution, which had been drawn up by a committee of three, was read and adopted. In it the object of this society is stated to be "the association of working naturalists, for the discussion of methods of investigation and instruction, laboratory technique and museum administration, and other topics of interest to investigators and teachers of natural history, and for the adoption of such measures as shall tend to the advancement and diffusion of the knowledge of natural history in the community."

Membership in the society is limited to instructors in natural history, officers of museums and other scientific institutions, physicians, and other persons professionally engaged in some branch of natural history. Any member may present to the executive committee names of candidates for membership, but only those candidates who are approved by the executive committee may be elected to membership by a majority of the members present at any meeting of the society. The annual fee for membership is two dollars.

The officers are elected by ballot at the annual meeting of the society, their official term commencing at the close of the meeting.

The five officers of the society constitute the executive committee, who are to recommend to the society, from time to time, such measures as they may deem expedient for the purposes of the society.

The proposed meetings of the association are to be held only in the New England and Atlantic states north of Virginia. They are not fixed to one locality, but are peripatetic; and it is intended to have them held in different college and university towns, to facilitate means of illustration.

The annual meeting is to be held on the second Wednesday of March in each year, unless otherwise ordered by the executive committee; and special meetings may be appointed at any time by a vote of the society or of the executive committee. The second meeting, for instance, is to be held in New York during the next Christmas holidays.

It is also declared to be the policy of the society, by correspondence and otherwise, to encourage the formation, and co-operate in the work, of societies of similar name and object in other parts of the country. We are informed, indeed, that a request for the formation of such an organization in the west has already been received, and favorably reported on.

We understand that some objections have been raised to the formation of a society distinct from the American association; but it will be evident from this sketch of its plan, that at present it is neither general enough in its object, nor broad enough in its geographical field, to permit of working in connection with the larger organization.

THE MATHEMATICAL TRIPOS IN THE UNIVESRITY OF CAMBRIDGE.

In January of this year the list of successful candidates for mathematical honors at the University of Cambridge was published under new rules, which provide, among other things, that the names shall be finally arranged alpha-

betically, and not, as heretofore, in the order of merit.

Under the old system, the tripos examination began generally on the first Monday in January. Two papers were set on each of the first four days of that week; then followed an interval of ten days, during which the work of the candidates was examined, and a list of those who had "acquitted themselves so as to deserve mathematical honors" published; finally, all such persons, but no others, were admitted to the rest of the examination, which consisted of a five-days' further test in the more difficult parts of mathematics and natural philosophy.

The names of all the candidates previously declared to be deserving of honors were then arranged in the order of merit, determined by the work of all the nine days, "into three classes of wranglers, senior optimes, and junior optimes;" and this list, which, of late years, generally contained about a hundred names, was then published in the Senate House.

The regulations [1] for the mathematical tripos examination directed that in no book-work paper of the first six days should be contained more questions than well-prepared students might be expected to answer within the time allowed for the paper; but they sanctioned the introduction, in all the subjects, of "examples and questions, by way of illustration or explanation, arising directly out of the propositions themselves." This last rule enabled the moderators and examiners to attach a rider to almost every question, and thus to increase the length of the papers far beyond what even the ablest man could write out properly in the time allowed.

An examination of the papers of the last ten years shows, that, in the fifteen papers devoted each year exclusively to book-work, most of the questions were such as a very well read man might have met with in the course of his studies; but that a very large proportion of the riders must have been new to all the candidates, and of such a nature as to test very effectually the power to do new work which the men had gained.

The great honor which has been always attached to the senior wranglership has given rise to the sharpest rivalry for first place; and this rivalry has extended to the tutors as well as to the candidates themselves. With the names of the six or eight men who stand highest in the list of wranglers, some of the daily papers have been in the habit of printing short accounts of their lives, and of giving the names of the teachers who prepared the men for the examination.

As a result of this, the most famous tutors were said to refuse all students who did not give promise of getting a good place in the list of honors; and those young men who were so fortunate as to secure the services of one of the celebrated 'senior-wrangler manufacturers' were more carefully looked after and trained than are the race-horses for the Derby.

There has been a continual struggle between the examiners and the tutors. The former have attached, each year, difficult and ingenious riders to comparatively easy book-work questions; so that in many cases the connection between the two is by no means obvious. The latter have tried to send up candidates so well read, and so well trained in the solution under pressure of new problems, that the amount accomplished should depend only upon the rapidity with which the student could write.

Let a person who has not had the benefit of this coaching attempt to write out one of the easier tripos [1] papers in a time equal to that originally allowed for it, and, whatever he may think of the wisdom of requiring a student to be prepared for examination in so many subjects at one time, he must get a profound respect for the ability, the attainments, and the *physical endurance*, of those who get places in the tripos. As far as one can judge from such accounts of the lives of higher wranglers as appear in the newspapers, the more ambitious students have, of late years, come up to the university with a good knowledge of analytic geometry, differential calculus, and mechanics. They have then spent nearly three years — studying in vacation as well as in term-time — in a special preparation for the examination for honors, and finally have been subjected to the terrible strain of writing the nine-days' papers. One cannot wonder that many students broke down in the course of preparation, and that many others succeeded in getting high rank at the price of lasting ill health.

Mr. Todhunter, in his 'Conflict of studies,' was one of the first to raise his voice against the system; but he was soon joined by others, who argued that the test of the students' powers would be quite as effective, and the evil results of the preparation fewer, if there were an interval of several months between the examinations in the more elementary subjects

[1] Cambridge university calendar for the year 1879, pp. 25–28.

[1] The tripos papers for each year make a quarto pamphlet, which may be had of Messrs. George Bell & Sons, Cambridge warehouse, 17 Paternoster Row, London. Price two shillings.

and in those of the last few days. Finally, after a good deal of agitation, a new system of regulations for the mathematical tripos examinations, to go into effect after January, 1882, was made and published in 1879. By these new rules, the whole examination is made to consist of three parts of three days each. The examination in part I., which is to begin on the Monday before the first Sunday in June, will be confined to Euclid, arithmetic, ordinary algebra, and the first three sections of Newton's Principia, with the elementary parts of trigonometry, geometrical conics, statics, dynamics, hydrostatics, optics, and astronomy. As Mr. Besant remarks in the 'Students' guide to the University of Cambridge,' however, "the word 'elementary' simply implies that the subjects in question are to be developed, as far as they can be, without the aid of the elaborate machinery supplied by modern analysis. In other words, the methods of pure geometry and ordinary algebra and trigonometry are to be the only instruments employed; and the effect of this restriction is, in many cases, to make the treatment of mathematical ideas more difficult, and to call out a more direct and powerful application of intellectual energy." From the results of this examination, the moderators and examiners are to publish a list of persons who have acquitted themselves so as to deserve mathematical honors; and these persons only are to be admitted to the examination in part II., which is to begin on the Monday after the second Sunday in June, and to cover algebra, trigonometry (plane and spherical), theory of equations, easier parts of analytic geometry (plane and solid, including curvature of curves and surfaces), differential and integral calculus, easier parts of differential equations, statics (including elementary propositions on attractions and potentials), hydrostatics, dynamics of a particle, easier parts of rigid dynamics, easier parts of optics, and spherical astronomy.

The moderators and examiners are then to publish a list of the candidates, taking into account parts I. and II., and arranging the men, in the order of merit, into three classes of wranglers, senior optimes, and junior optimes. The wranglers only are to be admitted to the examination in part III., which is to begin on the first Monday of the next January, and to cover the advanced parts of the following subjects: —

Group A. — Differential equations; calculus of variations; higher algebra; theory of equations; plane and solid analytical geometry; finite differences; higher definite integrals; elliptic functions; theory of chances, including combination of observations.

Group B. — Laplace's and allied functions; attractions; higher dynamics; Newton's Principia, bk. I., sects. ix., xi.; lunar and planetary theories; figure of the earth; precession and nutation.

Group C. — Hydrodynamics, including waves and tides; sound; physical optics; vibrations of strings and bars; elastic solids.

Group D. — Expression of functions by series or integrals, involving sines and cosines; thermodynamics; conduction of heat; electricity; magnetism.

Taking into account the examination in part III. only, the moderators and examiners are to publish in three divisions, *each division arranged alphabetically*, a list of those examined and approved; but they may place in the first division any candidate who has shown eminent proficiency in any one of the groups given above.

It will be seen that this arrangement limits the sharpest rivalry to the work in the more elementary subjects, and taxes the strength of the students far less than the old system did.

The first examination under the new rules was held last June. On the work of the first six days, twenty-nine men were placed upon the list of wranglers. Of these, sixteen offered themselves for examination in part III. in January of this year. Fourteen of these were approved, and the names published in the three divisions provided for. In the first division were placed those who, in last June's list of wranglers, were 1st, 2d, 3d, 6th, and 22d. In the second division the 17th wrangler stood alone. In the third division were the 4th, 7th, two bracketed as 8th, 9th, 16th, 18th, and 19th in the wrangler's list. It will be seen that the last examination changed the order of the names very materially.

The following list of names, made out from an examination of the honor-lists since 1747, will show that a large number of well-known men have taken high rank in the tripos. An asterisk means, that, in the additional examination for the Smith's prize, the person took first place; a dagger is attached to the names of those who took second place.

Name.	Rank as wrangler.	Year.
Maskelyne	7	1754
Erasmus Darwin	21	1754
Archdeacon Paley	1	1763

Name.	Rank as wrangler.	Year.
Lord Ellenborough	3	1771
* Wollaston	1	1783
Malthus	9	1788
* Sir J. Herschel	1	1813
† Peacock	2	1813
† Whewell	[illegible]	1816
* Sir G. B. Airy	1	1823
* Challis	1	1825
Willis	9	1826
De Morgan	4	1827
Lund	4	1828
Snowball	7	1828
* Cavendish (Duke of Devonshire),	2	1829
Murphy	3	1829
* Earnshaw	1	1831
Dean Alford	34	1832
Archdeacon Pratt	3	1833
* Kelland	1	1834
† Bishop Colenso	2	1836
Walton	8	1836
Sylvester	2	1837
George Green	4	1837
Gregory	5	1837
O'Brien	3	1838
* Frost	2	1839
† Bishop Goodwin	2	1840
* Stokes	1	1841
* Cayley	1	1842
* Adams	1	1843
Goodeve	9	1843
† Parkinson	1	1845
* Sir William Thomson	2	1845
* Todhunter	1	1848
Westcott	25	1848
* Besant	1	1850
† Watson	2	1850
Wolstenholme	3	1850
* Ferrers	1	1851
* Tait	1	1852
† Steele	2	1852
Godfray	3	1852
* Routh	1	1854
* J. C. Maxwell	2	1854
Fawcett	7	1856
* Aldis	1	1861
Freeman	5	1861
* Strutt (Lord Rayleigh)	1	1865
W. D. Niven	3	1866
Stuart	4	1866
Niven (Cork)	1	1867
† Clifford	2	1867
† G. H. Darwin	2	1868
* Pendlebury	1	1870
* Greenhill	2	1870
J. W. L. Glaisher	2	1871
† Lamb	2	1872
Garnett	5	1873
* Burnside	2	1875
† Chrystal	2	1875
Glazebrook	5	1876

THE NEGRITOS OF LUZON.

THE Ajetas, or Negritos, number over thirteen thousand, inhabiting chiefly the wooded mountains of northern, southern, and western Luzon. They have a dialect of their own. They are probably the aborigines of the Philippines, if not Papuans who went there from the southern groups of New Guinea at a very early period. They are short in stature, about five feet, slim, with crisp black hair, which they wear as a bushy mop, uncombed because uncombable. They have not the very flat nose, ugly features, thick lips, and intensely black skin of the African; but their color is dark, lighter in the dwellers in the sunless forests, the nose flattened, eyes large and restless, with the sclerotic yellowish. When young, the form is graceful; but the extremes of hunger and repletion, with their almost exclusive vegetable food, give to the adults a protuberant abdomen and lank limbs. The old women look like hags. They have no fixed habitations, but wander in bands of

NEGRITO OF LUZON.

NEGRITA OF LUZON.

fifty to a hundred wherever the supply of food is the richest. Their voices are shrill, and their gestures and agility monkey-like.

They are skilful hunters and fishers. Their arms consist of a bamboo spear, bow and arrows, with a lance-shaped head, often smeared with a resinous poisonous compound. They go nearly naked, the only covering being a narrow band of bark around the loins. Though savage in the interior, and occasionally of necessity cannibal, when brought into contact with the civilized Indians and the priests, they become harmless and confiding. They mix with the igorrotes and other wild tribes to such an extent that it would be difficult to find one of pure blood out of their native fastnesses. There are a few, probably hybrids, as servants in Manila, docile and trustworthy, whom it would be hard, without careful examination, to distinguish from a negro. They seem to have no religious ceremonies, or ideas of worship; but they respect old age, and venerate the dead.

There is great difference of opinion among ethnologists who have seen these Negritos, as to the race to which they belong. Semper (1869) and Davis (1870: *Journ. anthrop. soc. Lond.*), and authors generally, class them among the Papuans. Professor Rudolph Virchow, from the examination of the few skulls brought home by Jagor and others, and in the museums of Germany, denies their affinity to the Papuans, finding the head more monkey-like in form, the glabella extraordinarily developed, the frontal prominences slight, and traces of a frontal median crest; the temporal region elevated beyond the parietal protuberances, and not quite one-third of an inch behind the coronal suture; width at lower part of nose very great. The bones are weak and delicate, the tibiae laterally flattened, the humerus often perforated at the elbow, with a twist different from that of the European. They have undoubtedly been crossed by invasions of other tribes, both dolicocephalic (like the Malays) and brachycephalic (like the Mongolians). It is, therefore, extremely difficult to trace any pure race characters, as is evident from the conflicting statements of ethnologists.

NEGRITOS OF LUZON.

It seems to me that this people, the Negrillo of Dr. Charles Pickering (1848), and by him, and, after him, by Semper and Müller, classed as Papuans, — or, as Wallace maintains, of Asiatic origin, like the Andaman-islanders, — must be regarded as essentially Papuans, — Asiatic Papuans, if you please; that is, a mixture of this race with the Polynesians, like the Fijians and most of the Pacific-islanders, as distinguished from the present inhabitants of New Guinea. And this, I think, is warranted, whether we judge by the shape of the skull, the color of the skin, or the character of the hair. If originally Papuans, they have by persecution retrograded, until now the evolutionist may find in them the nearest approach to Darwin's 'missing link.' The Negrito, in his village, is not far above such an ape as might have been the ancestor of man, with the cerebral convolutions of the orang, the skull of the chimpanzee, the limbs of the gorilla, and

the chest of the gibbon — except that he can make a fire, and cook his food. There is the skeleton of a female in the Paris 'Jardin des plantes.' SAMUEL KNEELAND.

THE AMERICAN EXHIBIT AT THE LONDON FISHERIES EXHIBITION.

THE opening of the great international fisheries exhibition in London brings into view some of the numerous advances which have been made by our own commission in the investigation of the fisheries of the United States. In 1880, at Berlin, the extent of its researches and the importance of its achievements, indicated by the collections which were there displayed, were deeply impressed upon the representatives of other nations, and won for it the highest meed of honor. During the three years which have since elapsed, the activity of the commission has suffered no decline; and the display now made in London is undoubtedly superior in most respects to that made at the previous exhibition. It is impossible in this place to call attention to more than a few of the salient features of the American section of the exhibition.

The preliminary catalogue opens with a classified list of the aquatic animals and plants of North America, beneficial or injurious to man. Among the mammals, we note the group of fur-seals, procured some years ago through the efforts of the Alaska commercial company, and mounted with great care, and much fidelity to nature. The group is accompanied by a series of sketches by Mr. Henry W. Elliott, illustrating the fishery. A stuffed specimen of the rare ribbon-seal (Histriophoca equestris) from Alaska, and a skull of the Rhytina, are also included here. A remarkable pair of walrus-tusks, each 41 inches long and weighing about 12½ pounds, loaned by the Alaska commercial company, are exhibited in this connection. The cetacean fauna of North America is well represented by casts and skulls. The aquatic fish-eating birds, including those used by the fishermen for bait, are represented by groups of mounted specimens. The staining of the feet and bills in natural colors, a feature not hitherto introduced into the taxidermy of the national collections, gives a decidedly life-like air to these groups. Most interesting among the reptiles and batrachians, perhaps, are a large leather-back turtle (Dermatochelys coriacea) and a collection of twenty-four species of tailed batrachians (Siren, Necturus, Siredon, etc.). The exhibit of fishes is, as may be expected, very comprehensive. The alcoholic collection, selected with great care by Dr. Bean, includes over four hundred species. More than one hundred especially characteristic American fishes are represented by painted casts of a very high grade of workmanship. A series of photographs from fresh specimens, and another of engravings, both made under the direct supervision of the ichthyologists of the commission, are of especial interest to the zoölogist. During the exhibition, shipments of fresh fish will be sent to London daily by Mr. E. G. Blackford of New York. In the collection of mollusks the American oyster occupies a prominent place. By means of engravings, diagrams, and shells, the result of the latest researches upon its development, growth, and geographical distribution, are fully shown. The models of a giant squid (Architeuthis princeps) and of a giant octopus (Octopus punctatus) prepared under the direction of Mr. J. H. Emerton, have already been described in an earlier number of SCIENCE. A large series of other invertebrates — crustaceans, worms, echinoderms, and sponges — has been prepared by Mr. Richard Rathbun. Among the most interesting are a complete collection of the species of fresh-water crayfishes found in the United States, and a series of sponges illustrating artificial propagation by cuttings. The Algae of the United States are represented by a collection of marine forms by Professor Farlow, and a series of proofs of the plates of Wood's Fresh-water Algae.

The second section of the catalogue treats of the fishing-grounds, and the distribution of aquatic animals. The models and maps here included are the fruit of a vast amount of toil, and are of high scientific value. Each is worthy of detailed examination. The relief-models of the Atlantic coast and of the off-shore fishing-banks have been alluded to in a previous number of SCIENCE. Among the most interesting maps may be mentioned those showing the location and extent of the present and of abandoned whaling-grounds, by Mr. A. Howard Clark; the distribution of the pinnipeds, by Mr. J. A. Allen; the distribution of the seals and other fur-bearing animals of Alaska, by Capt. William H. Dall; the distribution of certain American fishes, by Mr. G. Brown Goode; and the location and extent of the oyster-beds of the United States, by Lieut. F. Winslow.

The third and fourth sections, which are devoted to fishery apparatus, would be almost solely interesting from a technological point of view, were it not for the numerous speci-

mens of Indian and Eskimo fishery implements which they include. The latter collection, which attracted much attention among the German anthropologists in 1880, has received many important additions through the explorations of Messrs. Dall, Bean, and Nelson, in Alaska.

Section E, which relates to the fishermen themselves, contains at least one collection interesting to the ethnologist. It illustrates the *cultus* of the American fisherman. Here are shown the games he plays, the books he reads, the products of the arts he affects, and the musical instruments upon which he performs. In another place is shown a series of large photographs from life, of fishermen of different nationalities employed in the fisheries of the United States.

The collection of biological works in the section devoted to literature forms an epitome of the development of the study of aquatic life in America. The writings of the earlier biologists — the elder Agassiz, Holbrook, Storer, Girard, Stimpson, and many others — are displayed; and in the list of special contributors are the names of Agassiz, Goode, Faxon, Dall, Jordan, Farlow, Ryder, Bean, Verrill, Lockington, and of many other prominent American biologists of the present day. It is much to be hoped that these volumes of papers, which have been gotten together with much labor both by the authors and the commission, may find their way, at the close of the exhibit, to the library of the commission or of the national museum.

Apparatus for scientific investigation of the waters is displayed not only by the fish commission, but by the coast-survey and signal-bureau as well. The latest improvements in sounding and dredging apparatus are represented, and the newest devices in barometers, thermometers, and other similar instruments. Among these are Professor Hilgard's recently invented densimeter and salinometer, Lieut. Tanner's deep-sea sounding-machine, Mr. Benedict's rake-dredge for annelids, and numerous others, many of which form part of the equipment of the fish-commission steamer Albatross.

In the manifold forms of apparatus for hatching fishes, the far-seeing zoölogist will see something more than machines for increasing the supply of food-fishes. Important though they be in that connection, they will appear in a new light as delicate instruments for embryological and physiological research, when a greater number of our ichthyologists shall have turned their attention from the taxonomy to the natural history of fishes.

We have not space to dwell upon the collections representing the various products of the fisheries; but there is much in the elaborate display of fish and fertilizers, of glues and oils, of leathers and furs and sponges, and the innumerable commodities which form the harvest of the seas, to attract the attention, and busy the thought, of the political economist and business-man.

It is too soon to say what rank the American division may attain in the exhibition; but one may be safe in remarking that there is no country in the world in which any of the great explorative industries have been subjected to a more thorough investigation from both a scientific and economic point of view than the fisheries of the United States are now undergoing at the hands of the national fishery commission.

NOTE RELATING TO A PECULIARITY DISTINGUISHING ANNEALED FROM UNANNEALED IRON.

THE writer has had occasion recently to study the effect of prolonged stress upon the various materials in common use in the arts, and, among others, upon the finer qualities of iron. The well-known experiment of Vicat, made a half-century ago, had never, so far as the writer was aware, been repeated. The extreme importance of the results obtained by him had apparently not been realized by either physicists or engineers; and it seemed advisable that the experiment be repeated, and, should the results obtained by Vicat be again reached, that the attention of both scientific and practical men should be again called to the subject. The repetition of Vicat's experiment has not only confirmed his conclusion, but has led to the discovery of a new and important, as well as peculiarly interesting, difference in the effect of prolonged stress upon annealed and unannealed iron.

In the autumn of the year 1881, the writer procured two lots of the best Swedish iron wire from Mr. William Hewitt, the vice-president of the Trenton iron and steel works, who very kindly had the wire drawn for the purpose. This wire was divided into two parts, one being carefully annealed, the other being left hard-drawn as it came from the blocks. These were tested in the usual way, and it was found that the hard wire had about double the strength of the soft. Nine pieces were taken from each reel for test, under prolonged static stress, and were suspended from hooks, in the study of the writer, attached to springs,

in order that the effect of jar should not enter into the experiment. They were then loaded with, respectively, in each set, 95, 90, 85, 80, 75, 70, 65, 60, 55, per cent of the average ultimate strength, as already determined. This was done in November, 1881. Since that date, a number have broken, as follows: —

Effect of prolonged stress. — Swedish iron wire.

Per cent max. static load.	TIME UNDER STRESS.	
	Hard wire (unannealed).	Soft (annealed).
95	80 days.	3 minutes.
90	85 days.	5 minutes.
85	17 months, unbroken.	1 day.
80	91 days.	206 days.
75	Unbroken.	17 "
70	"	456 "
65	"	456 "
60	"	Unbroken.
55	"	"

Thus, wire loaded with but 65 per cent of the breaking-load, as usually determined, broke after being subjected to stress for a period of fifteen months, when annealed; while hard wire carrying 85 per cent of the maximum temporary load remains unbroken after seventeen months. It is seen that these results are the same in kind as those obtained by Vicat, and confirm the conclusion that heavily loaded iron, as well as other metals and the woods, are likely to yield ultimately under loads that are sustained for short periods of time without apparent injury. This fact has been amply proven by earlier investigators, as well as by the writer; but the difference above observed, between hard and soft iron, has, so far as the writer has been able to learn, never, until now, been discovered.

Although the experiments of which this is the first are not yet concluded, this discovery, if such it prove, has seemed to be of sufficient importance to justify this note.

R. H. THURSTON.

Hoboken, N.J., April 22, 1883.

ELEPHANTIASIS, OR FILARIA DISEASE.

DR. A. F. A. KING, dean of the faculty of the National medical college, has recently cited a number of curious coincidences between the habits of the mosquito and the observed phenomena respecting malaria. There are, however, fatal objections to any theory that would connect the two; the coincidences rather indicating that the germs of both develop in similar places. The connection of the mosquito as an intermediary host in the full life-development of the haematozoön, Filaria sanguinis-hominis, however, has been very fully and conclusively made out by Dr. Patrick Manson, of Amoy, China, in the Customs medical reports, published in Shanghai by the order of the inspector-general of customs. Dr. Manson discovered the parent Filaria in the mosquito in 1878, and has since published several admirable articles, giving the results of his experiments; which, in the main,

FILARIA BANCROFTI.

a, female (nat. size); *b*, head and neck (× 55 diam.); *c*, tail, *d*, free embryo (× 400 diam.); *e*, egg containing an embryo; *f*, egg, with mulberry cleavage of the yolk (× 360 diam.) — After Cobbold.)

have been independently confirmed by Dr. Mackenzie of the London pathological society, Mr. T. R. Lewis in India, Dr. W. W. Myers, Drs. T. S. Cobbold, Wucherer, Bancroft, Araujo, and others. The facts have an entomological bearing, and are of great scientific interest and practical importance. They may be briefly stated as follows: —

In 1872 Dr. T. R. Lewis first announced the discovery of the immature or larval haematozoön, to which he gave the above trinomial

term, in the blood and urine of persons afflicted with chyluria. The mature form was first described by Cobbold as Filaria Bancrofti, in 1877 (*London lancet*, Oct. 6, 1877). As found in the lymph, the parent Filaria emits her young in the lymph-stream. The young Filaria is an elongate, transparent, very active creature, measuring $\frac{1}{90}'' \times \frac{1}{3500}''$. It makes its way from the lymph to the blood, where, however, it seems to undergo no growth or development. In this its new-born state it is enclosed in a delicate, transparent, and rather loose tunic or cyst, and is found in the blood of patients affected with elephantiasis, but only during the night. This disease is manifest in a thick, livid, tuberculate, and insensible condition of the skin, akin to leprosy. It is endemic over the more thickly populated and tropical portions of the globe, and, in its various forms, is very painful, resulting in deformity, and not infrequently in death. The best authorities now believe that various diseases of the lymphatic vessels and glands — as varicose groin glands, lymph scrotum, elephantiasis, and chyluria — are pathologically one and the same, and are due to the presence of this Filaria, which has, in fact, been recorded from South Europe, Asia, Australia, and Brazil; Dr. Araujo having verified at Bahia its occurrence in the mosquito, and otherwise confirmed the observations of Manson and others in different parts of the world.

Before the young Filariae can undergo their full development, they must first enter the body of the female mosquito (Culex mosquito), which sucks them up in her nocturnal attacks. Within the mosquito they develop in from five to six days, and upon the death of their host, or before, pass into water frequented by the mosquito for purposes of oviposition, and are thus returned, by drinking, to the human stomach, from which they make their way into some lymphatic vessel, where, the sexes meeting, the female remains, perhaps, for years, giving birth to active young.

In the Customs medical report for the half-year ending March 31, 1882, lately published, and but recently received in this country, Dr. Manson gives the results of some later observations which are full of interest. It seems that the periodicity in the Filaria disease has no connection either with temperature, atmospheric pressure, or light, but must be looked upon as an adaptation of the habits of the parasite to those of the mosquito. The conditions for the ingress of the Filariae into the circulation appear to be developed ordinarily during the last few hours of the waking state, and the parasites are eliminated during the last few hours of sleep. Under ordinary conditions of sleeping or waking, the embryos enter the circulation every evening, increase until midnight, and diminish as morning approaches, until they entirely disappear, and are not found from nine A.M. to six P.M. This periodicity of the parasite is independent of parturition in the parent, as reproduction is continued during the twenty-four hours.

The importance of thus tracing to their true source diseases whose origin has long been involved in mystery cannot be overestimated; and these facts would seem to give additional reasons for the filtering of drinking-water, and the use of mosquito-bars, in all tropical countries. Dr. Manson suggests that the facts ascertained in this connection may lead to a possible future explanation of the diurnal intermission and remission of fevers of the ague class. The most interesting conclusions that have been forced upon Dr. Manson are, that the presence of the parasite in the human body does not always or necessarily produce disease; and that, when disease is produced, it is by exceptional oviparous reproduction instead of the ordinary viviparous mode.

We give his conclusions in his own words: —

"In the instances in which the parent worm has been discovered, she was found in lymphatic vessels on the distal side of the glands. This has been shown to be in many if not in all cases her normal habitat. Her progeny, therefore, must travel along the afferent vessels, through the glands, and so on to the thoracic duct, and thence into the blood. The long, sinuous, and powerful body of the embryo is well adapted to perform this journey. But suppose, instead of this mature embryo, an ovum is launched into the lymph-stream prematurely, and before the contained embryo has sufficiently extended its chorion, then this passive ovum must certainly be arrested at the first lymphatic gland to which it is carried by the advancing lymph-current. It measures $\frac{1}{750}'' \times \frac{1}{300}''$, whereas the outstretched embryo is only about $\frac{1}{3000}''$ in diameter. It is much too large to pass the glands; and the embryo, rolled up in its chorional envelope, cannot aid itself. It becomes, in fact, an embolus. Now, Filariae are prodigiously prolific. Myriads of young are expelled in a very short time. I have watched the process of parturition in the minute Filaria corvi torquati. Every few seconds a peristaltic contraction, beginning low down in the uterine horns, and extending to the vagina, expels some twenty or thirty embryos. If this process of parturition occurs prematurely, or peristalsis is too vigorous, and extends to a point high up in the uterine horns, where the embryo has not yet completely stretched its chorional envelope, then ova are expelled. These, as they reach the glands, where the afferent lymphatic breaks up into fine capillary vessels, act as emboli, and plug up the lymph-channels, one after another, until the fluid that carries them can no longer pass. In this way the gland or glands directly connected with the lymphatic in which the aborting female is lodged are thoroughly obstructed. Anastomoses for

a time will aid the passage of lymph; but the anastomosing vessels will carry the embolic ova as well as the lymph. The corresponding glands will then, in their turn, be invaded; and so on, until the entire lymphatic system, connected directly or indirectly with the vessel in which the parent worm is lodged, becomes obstructed.

"This, I believe, is the true pathology of the elephantoid diseases: 1°. Parent Filaria in a distal lymphatic; 2°. Premature expulsion of ova; 3°. Embolism of lymphatic glands by ova; 4°. Stasis of lymph; 5°. Regurgitation of lymph, and partial compensation by anastomoses; 6°. Renewed or continued premature expulsion of ova; further embolism of glands. This process, according to the part of the lymphatic system it occurs in, the frequency of its recurrence, and its completeness, explains every variety of elephantoid diseases." C. V. Riley.

INTERNAL MOLECULAR ENERGY OF ATOMIC VIBRATION.[1]

The object of this paper is to examine at length the relative amount of energy which a molecule may possess with respect to any small degree of freedom of motion which its atoms may have as to each other. The theorem of the virial is applied to this motion of the atoms; and it is found, that in a molecule of a perfect gas consisting of but two atoms, which are at a mean distance, r, from each other, and which suffer a small displacement whose mean maximum amplitude is δr under the action of elastic forces, the energy of atomic vibration will be to that of translation parallel to any assumed direction in space as δr to r. It is further shown that this result is of such a character as not to be restricted to molecules of two atoms merely, nor to atoms which are attracted toward their mean position by forces varying simply as the first power of the displacement; so that the result arrived at is of a general nature which may be stated thus: the energy of interatomic vibration depends upon the atomic displacement within the molecule, and in such a way, that, when this displacement is a vanishing quantity compared with the dimensions of the molecule, then this energy of internal vibration is a vanishing quantity compared with the energy of motion of the molecule as a whole.

This result is in confirmation of the results obtained by the author in his previous paper upon 'An extension of the theorem of the virial,'[2] etc., in which he expressed the opinion that the results there obtained led to the conclusion, that "in case partial constraints not amounting to the loss of entire degrees of freedom are introduced, the energy will no longer be equally distributed among the co-ordinates, but will be influenced by their constraints."

This being in direct contradiction to the conclusions which have been deduced by Boltzmann and by Watson from the discussion of the distribution of energy by the method of generalized co-ordinates, an examination is made of the point in this hitherto accepted theory from which the contradiction arises, and an error is pointed out in the method of employing the fundamental expression for the distribution of velocities. The error is of this nature: the law expressing the most probable distribution of velocities with respect to any single co-ordinate is the same as that of the most probable distribution of errors of observation, and contains a single arbitrary constant, to be determined by the observations themselves. It has been assumed that this constant is the same for each co-ordinate, which is, in effect, assuming the very point to be proved. It is here pointed out, that doing this commits an error of the same nature as is done in assigning equal weights to unlike observations without first showing that their weights are equal.

The computations made by means of the virial show conclusively that the mean energy (i.e., the weight) is not at all the same for one degree of freedom as for another; and, in order to find how one is related to another, it will be necessary to take account of the forces acting, as has been done in this paper and in the previous one.

This extension of the theory leads to numerical results in close accordance with observed values of the specific heats of gases, and their ratio, without previous knowledge of these quantities for any gas; thus computing these quantities for the first time solely from the general equations of mechanics.

[1] Abstract of a paper upon a further extension of the theorem of the virial to the internal molecular energy of atomic vibration. By H. T. Eddy, Ph.D., Cincinnati. Read before the Section in physics and chemistry of the Ohio mech. inst. April 26, 1883.

[2] *Sc. proc. Ohio mech. inst.*, March, 1883; Science, p. 65.

ON THE DEVELOPMENT OF CHLOROPHYLL AND COLOR GRANULES.

The view has been generally entertained, based largely on the admirable investigations of Arthur Gris, that chlorophyll-granules are produced by direct differentiation of the protoplasm of assimilating cells. Led by his study of certain protoplasmic bodies in the cells where nutritive matters are stored for future use, and following out a suggestion made by Schmitz in his recent work relative to the assimilating bodies in certain Algae, A. F. W. Schimper (*Botan. zeit.*, Feb. and March, 1883) has made a detailed examination of the origin of chlorophyll-granules, which indicates that the views of Gris are erroneous. At the points of growth examined by him, Schimper uniformly found that well-formed granules already exist, and that, from subsequent division of these, all the chlorophyll-granules are produced. From these, and not, as heretofore believed, from the differentiation of the protoplasmic mass in the cell, arise the granules which later, under the influence of light, take on their characteristic color. One of the most interesting cases reported by him is that of Azolla. The point of growth at the root contains bright green chlorophyll-granules about as large as those in the older parts, and in these granules the process of division is to be distinctly traced.

In those points of growth where the tissues are as yet free from color, he has been also able to follow the division, step by step, up to the production of complete green granules. The bodies from which the granules are produced are present, likewise, in all points of growth of seedlings. Just here is found the most interesting feature of this investigation. From these bodies, which he well terms 'plastides,' come three classes of protoplasmic bodies, somewhat resembling one another in shape: namely, 1, the chlorophyll-granules, or *chloroplastides;* 2, the starch-formers, which, with the allied white or colorless bodies, he calls *leucoplastides;* and 3, the bodies which possess colors other than green (for instance, the granules in petals and the like), to which he gives the name *chromoplastides.* To illustrate this from a single case, we will allude to Impatiens parviflora. The very transparent cells at the point of growth contain plainly visible leucoplastides. In cells of the same age they are of the same size, often constricted, always sharply defined. These can be traced by plain transitions into chloroplastides on the young stem and the zone of forming leaves,

while, at the point of growth in the root, only leucoplastides are to be seen. Moreover, in following the plastides farther back, he found them present in the seed itself; and this he conjoins with the well-known fact, that chlorophyll-granules are to be found ready formed in certain seeds.

The destiny of the plastide depends upon the tissue which is to be developed from the meristem. Some of them remain colorless, that is, as leucoplastides, and serve to produce starch-grains at the expense of assimilated matters; others become chloroplastides to produce assimilated matter; while still others are to furnish colors to flowers and fruits. This simplest of all organs is therefore capable of wide metamorphosis, by which it becomes fitted for its diverse functions.

Nor is this all. The same plastide can become at different stages of its life a leuco-, a chloro-, and a chromo-plastide. But which of these is the primal form? To this the author answers unequivocally, the chloroplastide; and he believes that the others have all been derived therefrom. Reserving some of the other features of this suggestive paper for another notice, it may be said that the terms proposed by Schimper are quite equivalent to those given by Van Tieghem in his Botany, now in course of publication, as *leucites* and *chloroleucites*, and, in part, to his *xantho-leucites*; but, so far as their development is concerned, the latter author follows the accepted view of Gris. G. L. Goodale.

LETTERS TO THE EDITOR.

Molluscan rock-boring.

In giving lectures upon building-stones my attention has been often called to the action upon them of boring mollusks, echini, annelids, sponges, etc., when used in submarine constructions.

In Albany Hancock's paper on the above subject (*Ann. mag. nat. hist.*, (2), ii. 225, pl. viii.), are figured numerous siliceous grains, found about the foot and mantel, which he regarded as secreted by the mollusk, and employed in excavating the burrow. While Hancock's conclusions are generally denied, I have not seen any explanation of the observed particles. The forms figured by him, especially in fig. 6, resemble the grains (principally quartz) observed in the microscopic study of mud and other earthy deposits. Such grains would naturally be the result and not the cause of the rock excavation; and it is difficult to see how the animal could be in the position in which it is found, without their presence about it.

Perhaps some zoölogist can state if this explanation has been given before, and whether it be correct or not. M. E. Wadsworth.

Cambridge, Mass., April 30, 1883.

The Lake Superior rocks.

Prof. N. H. Winchell is evidently right in saying, in Science, No. 12, that, in my letter in No. 5, I misrepresented his position on the unconformity in the St. Croix valley. I had said that he had strenuously denied this unconformity, because my recollection of a conversation on the subject, held with him in 1880, was to that effect. But, on turning to the reference he gives in his First annual report of the geological survey of Minnesota, I see that he had announced such an unconformity as long ago as 1872, which, of course, I should have known before; so that I must have misunderstood him.

As to the other matter, — viz., the relation of the 'St. Croix' or Potsdam sandstone of the Mississippi valley to the 'eastern sandstone' of Lake Superior, — I certainly have understood from his various reports, that he regarded them as distinct. But I am very glad to be set right on these points, though regretting very much having misunderstood Professor Winchell; for it narrows down the question at issue between us very materially. R. D. Irving.

Track of meteor.

In your first number, Feb. 9, 1883, I saw an account of a meteor witnessed by Capt. Belknap of the U. S. S. Alaska, Dec. 15, 1882, and reference to a similar phenomenon seen at Lake Winnipeg June 29, 1860. On the evening of June 17, 1873, in early twilight, and before any stars were visible, upon coming out of my hotel in Vienna, I found a crowd of persons watching a similar phenomenon, which appeared to be just north of the Kahlenberg. Upon inquiry, I learned that a meteor had been seen to fall a few moments before, but without noise; and a subsequent watch of the daily papers gave no account of any meteorite, which could hardly have escaped observation in this settled section of Austria. It would appear, therefore, that this meteor must have been entirely dissipated in vapor before reaching the earth.

When I first saw the luminous track, I at once supposed it, from appearance and color, to be the flame from a distant zinc-furnace; but it was gradually changed from its straight course to a curved line closely resembling fig. 3 in Science, No. 1, p. 5, and appeared to be borne to and fro by the gentle currents of air. It extended fully 30° from the horizon, and was distinctly visible for half an hour after my attention was first called to it. From a letter sent by me the next day to a friend in this country, the above facts are taken, in which letter I roughly sketched the appearance of the luminous cloud, after a few minutes from the fall of the meteor, as shown by the accompanying cut. Peter Collier.

AUGUSTUS DE MORGAN.

Memoir of Augustus de Morgan; with selections from his letters. By his wife, Sophia Elizabeth de Morgan. London, *Longmans, Green, & Co.*, 1882. 10, 422 p., portr. 8°.

If the degree of interest which attaches to the life of a hard-working mathematician is, from the nature of the case, less than strong; if the biography of De Morgan is in this respect in marked contrast to that of a man whose life is a picture of his time, and who has had himself a distinct effect upon his time, — to the life, say, of Harriet Martineau, which was included within nearly the same years as the life before us, — it is none the less true

that the record of an eminent scientific man, his nature and his nurture, and his way of regarding the important questions of his day, is material which one would not willingly have lost. The present memoir disclaims being written from a scientific point of view; and it does not, in fact, furnish ground for modifying the very just estimate of De Morgan which is given by Mr. Jevons in the Encyclopaedia britannica. Nor is it, on the other hand, a very personal memoir. The letters are nearly all addressed to scientific friends, and are on questions of general interest. His correspondence with his wife and children, from whom he was seldom separated, was fragmentary, and not suited for publication; and, with respect to domestic details, his biographer has done what she knew her husband himself would have wished. He was always averse to making known what nearly concerned his family.

De Morgan was born in the year 1806, at Madura, in the Madras presidency. His father, Col. John De Morgan, was in the service of the East India Company; and both his grandfather and his great-grandfather had served under Warren Hastings. His mathematical powers, as well as his taste for music, he derived from his mother, who was the granddaughter of James Dodson, author of the *anti-logarithmic canon*, a friend of De Moivre, and an early fellow of the Royal society. Soon after De Morgan's birth, the family returned to England, and settled first at Worcester. The young Augustus was indoctrinated in various branches of 'general knowledge' in many different private schools, after having learned reading and numeration from his father at the age of four years. His estimate of the character of the instruction which he received appears, from his belief in after years, that, of exceptional children, those who are least taught have the best chance of a healthy development. One element of his early teaching — the formal observances and the rigid religious doctrines in which he was trained — strongly tinged his character in after life. He was made to learn by heart long passages of Scripture, which, from frequent repetition, had become meaningless to him; he was taken to church twice in the week and three times on Sundays, and required to give an abstract of every sermon he heard, until church became a place of penance to him, and Sunday the one wretched day of the week. In after years he was unable to listen for any length of time to speaking or preaching: to get rid of memories of dreary sermons, he had to think of something different from what was being said.

Until after the age of fourteen, he had shown rather less than the usual aptitude for mathematics. He said one day to an old gentleman, a friend of the family, who saw him making with great care a figure with ruler and compasses, that he was 'drawing mathematics.' From him the future mathematician learned, greatly to his surprise, that he had hitherto missed the aim of Euclid, and that geometry does not consist in drawing accurate figures; and he was soon intent upon the first demonstration of which he ever understood the meaning. From that time his progress was rapid. At the age of sixteen he entered Trinity college, Cambridge; and in his second year his tutor writes, "He is not only in our first class, but far, very far, the first in it." Airy, Peacock, and Whewell were among the teachers whose instruction he particularly prized, and with whom he kept up a life-long friendship and correspondence. In 1827 he took the degree of fourth wrangler only, his wide mathematical reading having led him too often far away from the courses prescribed for examination; and to the bitter disappointment of his mother, who had hoped to see her oldest surviving son in the church, he came up to London soon afterwards, and entered at Lincoln's Inn. In London he made the acquaintance of William Frend, whom he describes as a man of singular directness and clearness of mind, a clergyman of the church of England, and a member of the old Mathematical society, who rejected negative quantities and the doctrine of the Trinity. In his house he became a frequent guest; and his children were surprised to find that this brilliant young man, of whom great things were expected in science, rivalled them in love of fun and fairy-tales and ghost-stories, and that he could even show them a new figure in cat's-cradle. It does not appear why so auspicious a beginning did not result in his marriage to Sophia Elizabeth Frend until ten years later.

The two great universities were closed to De Morgan on account of his strong repugnance to sectarian restraints on freedom of opinion; and hence he welcomed the opening of University college (called at first the London university), not only as meeting a great want of the time, but as offering to himself a prospect of leaving the study of law for a more congenial occupation. Out of thirty-two candidates, he was unanimously elected to the chair of mathematics, in spite of his being only twenty-one years of age. Three years later he handed in his resignation. The professor of anatomy had been removed on account of some complaints preferred against him by his class; and De

Morgan immediately addressed a letter to the council, saying that he considered it discreditable to hold a professorship one moment longer in a college in which a professor might be removed and disgraced without any fault on his part. His resignation was accepted; but, after five years of private teaching and voluminous writing, he returned to his university. The sudden death of his successor at the end of a summer vacation induced him to offer to fill the vacancy until Christmas; and his belief, that, owing to changes in the management, his former objections to holding office would not recur, led him to accede to the request of the council that he should permanently resume his chair.

De Morgan's life is chiefly a record of his labors and his publications. He gave regularly twelve lectures every week, besides occasional extra courses; and for half an hour after each lecture he remained in his place to give personal assistance to those students who needed it. This, with an hour for correcting exercises, made four hours of solid work for each day in the week, without counting the time required for preparation. As a lecturer, he showed unrivalled skill. Mr. Sedley Taylor writes, "His exposition combined excellences of the most varied kinds. It was clear, vivid, and succinct; rich, too, with abundance of illustration, always at the command of enormously wide reading and an astonishingly retentive memory. A voice of sonorous sweetness, a grand forehead, and a profile of classic beauty, intensified the impression of power . . . which he made upon his auditors." He had a great hatred of cram, and no confidence in the power of an examination to determine the true value of a student's knowledge. "The claims which college examinations might be supposed to have on the studies of his pupils were never allowed to influence his programme in the slightest degree." He wrote the following in illustration of a Cambridge examination: —

Q. — What is knowledge?

A. — A thing to be examined in.

Q. — What must those do who would show knowledge?

A. — Get up subjects, and write them out.

Q. — What is getting up a subject?

A. — Learning to write it out.

Q. — What is writing out a subject?

A. — Showing that you have got it up.

The list of De Morgan's publications is a very long one. Much of his writing was of a kind which it is extremely useful to have done at the time and to have well done, but which is not destined to be preserved, and which it is more economical to extract from a man of less than De Morgan's ability. He wrote one-sixth of the Penny cyclopaedia, and he made voluminous contributions to the Journal of education, the British almanac and companion, the Dublin review, Notes and queries, the Athenaeum, the insurance journals, and to the memoirs and obituary notices of the Astronomical society, in whose affairs he took an active part for thirty years. His most important contributions to science are his papers on the Foundations of algebra and on the Syllogism, his text-books on Formal logic and on the Calculus, and his treatises in the Encyclopaedia metropolitana on the Calculus of functions and the Theory of probabilities.

Such an amount of labor left very little time for pleasure or relaxation; and, in fact, De Morgan writes near the end of his life, "I have never been hard working, but I have been very continuously at work. I have never sought relaxation. And why? Because it would have killed me. Amusement is real hard work to me." He had, however, an interesting circle of friends, who came frequently to his house, and in whose society he found great pleasure. Libri (the author of the History of mathematics), Arthur Hugh Clough, Miss Muloch, and Mrs. Follen the abolitionist, were among them. Throughout his life, also, he was an inveterate reader of novels, good and bad. Puzzles, and even puns, were interesting to him. He made a collection of over eight hundred anagrams on his own name; and his fondness for paradox was so well known that the circle-squarers all sent him their most curious investigations. He was a thorough believer in the phenomena called spiritual. After describing some striking occurrences in spirit-rapping, he writes, "I was perfectly satisfied that some thing, or some body, or some spirit, was reading *my thoughts;*" and in regard to mesmerism, "Of the curative powers of this agent I have no more doubt than one has of things which he has constantly seen for years." His feelings on the subject of slavery were very intense, and he sat up the greater part of one night to finish Uncle Tom's cabin.

De Morgan presents another instance of the fact that a man's views of women in general are seldom dissociated from the result of his observations upon the few women who stand nearest to him. His clever wife had the effect of dispelling the prejudices with which his rather narrow-minded mother had inspired him. She writes, "I must not conceal the fact, that, in the earlier part of his life, he held man-

like and masterful views of women's powers and privileges. Women, he thought, ought to have every thing provided for them, and every trouble taken off their hands: so the less they meddled with business in any form, the better. But these very young notions gave way, as he saw more of life, to wiser and more practical ones. He found that women were not utterly helpless; and his love of justice, combined with his better opinion of their powers, made him quite willing to concede to them as much as he would have desired for himself; namely, full scope and opportunity for the exercise of all their faculties. This was shown by his giving lectures gratuitously in the Ladies' college for the first year after its foundation, and by the interest he felt in the success of those brave women who first attempted the study of medicine."

De Morgan's letters are of a kind which it is very interesting to receive at the natural intervals at which they are written. When taken *en masse*, the logico-mathematical language in which they are couched, amusing in small doses, and their wit, excellent but monotonous, become wearisome. It is too much like sitting down to a continuous reading of the Budget of paradoxes.

In regard to his ideas on religion, De Morgan was always extremely reticent; but in spite of the disastrous effect of his early training, and in spite of his strong aversion to unfounded beliefs, he preserved a deeply religious tone of mind, and a firm faith in the Christian religion. At the same time, nothing could be more frank and uncompromising than the way in which he meets the renewed insistance of his mother, upon the occasion of the death of a sister to whom he was much attached, that he should renounce his freedom of opinion. His letter, if somewhat severe and untender, is still a splendid example of that strong rectitude of mind which was characteristic of him, and which did not permit him to gain any thing, even family harmony, at the cost of concealment.

The last years of De Morgan's life were years of disappointment and grief. The university in which he had labored with untiring energy until the age of sixty became once more impossible to him. The reiterated pledges of its founders and subsequent directors, that the essence of its being should be absolute and complete religious equality in every portion of its organization, were broken; and De Morgan could not lend his countenance to a less liberal or a more worldly line of policy. Upon the refusal of the council to appoint to the chair of mental philosophy and logic the Rev. James Martineau, who had been recommended by the senate on account of his wide reputation as a preacher of an unpopular sect, De Morgan once more handed in his resignation. A year later occurred the death of his second son, George, a young man of great mathematical promise, and one of the two first projectors of the present Mathematical society. From this time De Morgan's health and vigor were not what they had been; and after an attack of congestion of the brain, from which his recovery was slow, he died in 1871 of nervous prostration.

WHITE'S FOSSIL MOLLUSKS OF NORTH AMERICA.

A review of the non-marine fossil Mollusca of North America. By C. A WHITE. Washington, *Government printing-office*, 1883. 1, 144, 3 p., 32 pl. sm. f°. [Annual report U. S. geological survey, 1881-82, *separately paged.*]

No work is more useful to the biologist, whether his studies relate to recent or to fossil forms, than the collection and careful illustration of scattered material. In the book under consideration, Dr. White has produced for the student of mollusks, in either their recent or their paleontological relations, a much-needed and permanently valuable work of reference. Owing to their wide range, fecundity and accessibility, the class of mollusks included under his title are, all over the world, better known, more thoroughly studied, and more easily collected, than those of the sea. Hence it is to be expected that the material for learning what lessons they have to teach will be available for students much sooner with the land and fresh-water mollusks than with the marine species considered as a class. Publications such as this, perhaps more than any other single means, will serve to shorten the time which must elapse before such a condition of the science is reached. Stratigraphical paleontology will not be so much the gainer as biology in a wider sense, since the uniformity of lacustrine and fluviatile conditions interferes with that differentiation which makes of some groups of marine mollusks valuable indices of geological time.

Dr. White has brought together excellent figures of nearly all the species of the groups under consideration belonging to North American paleontology, from the oldest strata in which they are known, to and including the miocene tertiary. One doubtfully pliocene species is mentioned; but the fossils of the later marls, and such deposits as that of the Colorado

desert, are not considered. Most of these are known as recent shells also; but we think it would have been a useful addition to the collection if such extinct forms as Tryonia had been included.

To the catalogue in tabular form and the explanation of the plates are prefixed a statement of the object and method of the work, a *résumé* of the subject by zoölogical families, and some general considerations. In these last the author, we think, is the first to enunciate certain propositions, which, though simple, constitute an important advance over previous statements of the general topic. In brief, he points out the high probability that lacustrine, at first brackish-water forms, were derived from marine species by imprisonment due to rising seashores, forming, first estuaries, then lakes; afterward differentiated so as to become inured to water without salt, or, in other cases, exterminated by water too fresh, or in lakes without an outlet, by concentration of saline matters. This view is not wholly novel; but the author goes on to supplement it by pointing out how, from the gradual conversion of lakes into rivers, and the persistence of the latter through epochs of geological change, the remarkable persistency of fluviatile types is accounted for, and problems of present geographical distribution may be solved.

Too much space would be required for an analysis of the work in detail: a few points have been noted for mention. It seems a little startling to have oysters, Anomiae, and mussels presented as non-marine, until we learn that they were of the peculiar brackish-water beds in the Laramie group, and were doubtless accustomed to almost lacustrine conditions. The oldest forms treated of are Naiadites and certain supposed Anodontae from the Devonian (the latter much suggesting in appearance Lithodomus and its allies); but if these were not, as is supposed, true fresh-water folk, then the earliest of the latter date from the trias. Six families of Conchifera, in all, and sixteen of Gastropoda, are represented in the catalogue. It might be suggested that an analogue of Unio belliplicatus may, perhaps, be found living in Nicaragua, and that Cerithidea lives rather abundantly on the Californian coast.

The proof-reading of this volume is not up to the usual standard of the Government printing-office, and the index is disappointingly meagre. The arrangement of the numbers to figures on the plates is confused and puzzling: it can hardly fail to cause a serious loss of time to those who consult them. On the other hand, the paper and press-work are above the average, and the execution of the figures unusually good.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

GEODESY.

Geodetic night-signals. — Mr. C. O. Boutelle, of the U. S. coast-survey, finds that the magnesium light as used by the survey may be used for distances as great as forty-five to seventy miles, and that the ordinary student-lamp with a parabolic reflector may be seen as far as forty miles. A report on night-signals was published by the coast-survey last year. The advantages stated in the report, as derived from greater steadiness of the atmosphere, and comparative freedom from lateral refraction upon long lines of sight during night observations, have been signally verified during the seasons of 1881 and 1882. — (*Rep. U.S. coast geod. surv.*, 1880.) [859

MATHEMATICS.

A definite integral. — In a brief note, M. Korkines gives a simple proof of a theorem due to M. Tchébychef. The theorem relates to the integral $\int_0^1 \phi(x)\,\psi(x)\,dx$, where ϕ and ψ must satisfy one of the two conditions: 1°, they simultaneously increase or simultaneously decrease for all values of x lying between zero and unity; 2°, or one of them must increase and the other decrease for the same values of x. In the first case, M. Tchébychef's theorem is

$$\int_0^1 \phi(x)\,\psi(x)\,dx > \int_0^1 \phi(x)\,dx \int_0^1 \psi(x)\,dx\,;$$

in the second case,

$$\int_0^1 \phi(x)\,\psi(x)\,dx < \int_0^1 \phi(x)\,dx \int^1 \psi(x)\,dx.$$

M. Korkine makes these theorems the immediate consequence of a simple identity. — (*Comptes rendus*, Jan. 29.) T. C. [860

Linear differential equations. — In a previous communication to the academy, M. Goursat has solved, for a special class of equations, the problem to find the entire number of substitutions to which a system of fundamental integrals of a given equation may be subjected, corresponding to all the different closed paths which the variable may describe. The general integral in that case was shown to be expressed by hypergeometric series of higher orders. In the present paper, M. Goursat develops more fully his method, and applies it to the equation of the third order, remarking that the method followed is identically the same for equations of any order. — (*Comptes rendus*, Jan. 29.) T. C. [861

Functions of two independent variables. — M. Picard has given a series of notes upon this subject, determining the functions of two independent variables, u and v, which remain invariable when we effect upon u and v any of the infinite number of substitutions of a linear discontinuous group. In the present paper M. Picard considers, in a general

manner, a discontinuous group for all points (u, v) of the region D, defined by

$$u'^2 + u''^2 + v'^2 + v''^2 < 1,$$

where

$$u = u' + iu'', \ v = v' + iv''.$$

The author shows that every substitution of the group transforms each point of the limit of D into another point of the same limit. He also shows that there exist functions, F, of u and v, only defined in the region D, and which leave invariable all of the substitutions of the group. The only groups considered are those possessing this property; viz., we can always find in the region D a region R, having no point common with the limit of D, and such that, in the interior of R, there is one, and only one, point which corresponds to any point (u, v) by means of the substitutions of the group. — (*Comptes rendus*, Jan. 29.) T. C. [862

Differential equations. — M. Steen treats certain differential equations of the second order, an account of which has already appeared in another place. The differential equations are of the form

$$y'' - (a \cot x - b \operatorname{tang} x)\, y' + cy = 0,$$
$$v'' + (a \cot x - b \operatorname{tang} x)\, v' + cv = 0;$$

x being the independent variable, and the accents denoting differential co-efficients. These equations are treated for special values of the constants a, b, c, and the integrals exhibited in the form of series of trigonometric functions, and also in the form of definite integrals of certain trigonometric functions. — (*Vidensk. selsk. skr.*, (6), *naturv. math. afd.*, i. 6.) T. C. [863

PHYSICS.

Mechanics.

Radius of gyration of a rifled projectile. — Lieut. C. A. Stone deduces a formula for the determination of this value. Applied to the 700-lb. Butler shell, he obtains K = 4.1224″; while the bureau of ordnance, U.S.A., found by experiment for this shell, K = 4.1005358″. Lieut. Stone discusses, also, the ratio of the forces necessary to give translation and rotation to a rifled projectile, and the ratio of the ranges of a projectile measured on the horizontal and on an inclined plane in a non-resisting medium. — (*Proc. U. S. nav. inst.*, viii. no. 4.) C. E. M. [864

Acoustics.

Hydrogen-whistles. — Mr. Francis Galton has continued his researches upon the production of notes of excessively high pitch, and their audibility to different animals, wishing to test the powers of insects in this respect. The idea has occurred to him of blowing his high-pitched whistle with hydrogen-gas, and so increasing its shrillness. Preliminary experiments with coal-gas have given good results; and Mr. Galton thinks that he can produce a sound due to 624,000 vibrations per second. — (*Nature*, March 22.) C. R. C. [865

Intensity of sound. — Vierordt has studied the subject of the estimation of the intensity of sound by the process of dropping a body upon a sonorous plate. The intensity of the sound produced is proportional to h^e, where e is a co-efficient to be determined experimentally. A formula given by Oberbeck is,

$$e = \frac{\log \frac{P}{p}}{\log \frac{H}{h}},$$

if h is the height fallen through by the heavier weight P, and H the greater height fallen through by a lighter weight p, when the intensity of the sound produced by striking the plate is the same. A large number of measurements are recorded, from which the author concludes that there is a general measure of the strength of sound. With spheres of the same material, and plates of definite material and weight, the value of e varies but slightly with increasing weight of the sphere, or with variation in the height of fall. — (*Ann. phys. chem.*, No. 3, 1883.) C. R. C. [866

Optics.

(Photography.)

Astronomical photography. — At the Meudon (France) observatory they are studying movements of photospheric matter with the aid of series of images obtained with the 'photographic revolver.' They are also working at photographic photometry, the principle being, that the intensities of two light-sources are in the inverse ratio of the time they take for the same photographic work; e.g., producing the same tint on two quite similar plates. The method will be applied to data of the comet of 1881, the full moon, etc. — (*Nature*, March 15.) W. H. P. [867

Astronomical photography. — At the March meeting of the Royal astronomical society, Dr. Gould gave an account of his work at Cordova. He considered that he had been successful in photographing stars down to the tenth and a half or twelfth magnitude. Mr. Common showed a photograph he had taken of the great nebula in Orion, the appearance of which, in many parts, gave rise to an interesting discussion; the majority of those taking part inclining to the belief that the photograph represented certain unknown dark objects in space. — (*Brit. journ. phot.*, March 23.)

[No such appearance has been noted here in the excellent photographs of this object taken by the late Dr. Henry Draper.] — W. H. P. [868

Positive prints from a positive. — MM. Cros and Vergeraud have sent to the French photographic society a communication on the above subject. A suitable paper is covered with a solution of ammonium bichromate, 2 grams; glucose, 15 grams; water, 100 grams. This is dried, and exposed to the light under a positive. When the uncovered portions of the paper, which were at first of a decided yellow, have become gray, the exposure is discontinued, and a rapid immersion made in a silver bath, composed as follows: silver nitrate, 1 gram; acetic acid, 10 grams; water, 100 grams. The image appears immediately of a blood-red color, formed by the bichromate of silver. In all parts where the light has acted, the bichromate has been reduced by the glucose; and, where the variable opacities of the image have protected in different degrees the sensitive film, the bichromate of silver remains insoluble in the water of the subsequent washing. If dried by fire, the image remains red; if dried in the open air and in the light, especially in the sun, it becomes dark brown. To obtain a black image, it suffices to expose the dry prints to sulphurous-acid gas. A bath of sulphite of copper and potash in solution gives a more intense black. — (*Philad. phot.*, April.) W. H. P. [869

Electricity.

Electro-optical properties of quartz. — W. C. Röntgen confirms and extends results obtained in a former paper (*Ann. phys. chem.*, no. 3). The specimens used were a thick circular plate, cut perpendicular to the principal axis of the crystal, and a sphere. The apparatus for investigating the quartz-sphere was an old microscope. The quartz was laid on the

object-stand, and the weighted microscope-tube let down upon it. There are three planes through the principal axis, making angles of 120° with each other, such that all pressures in these planes, or parallel to them, produce minimum electricity at the points of pressure. Pressure exerted perpendicular to these minimum planes produces maximum electricity. Each of the six fields into which the minimum planes divide the sphere possesses the property that all points of pressure within it are electrified to the same sign: these signs are opposite in adjacent fields. Pressure in the direction of the principal axis gives each of the six fields its peculiar sign: pressure in any other direction divides the sphere into two oppositely electrified halves, the plane of division passing through the principal axis. No direction of pressure produces electricity at the ends of the principal axis. If the direction of pressure is a maximum axis, the plane of division is the minimum plane perpendicular to it (the signs of the halves correspond to the signs of the fields in which the maximum axis lies); but, if the pressure is in this minimum plane, the electrification is exactly reversed. The experiments seem to show, that, if the direction of pressure rotates about the principal axis with an angular velocity ω, the plane of division rotates in the opposite direction with a velocity 2ω. The author then shows that the optical properties of quartz in an electric field can be accounted for by the expansions and contractions which quartz undergoes under electrical strain, according to the principle of reversibility of piezoelectric effects pointed out by Lippmann. This result has also been reached independently by Kundt in *Ann. phys. chem.*, no. 3. — (*Ann. phys. chem.*, no. 4.) J. T. [870

Corrosion of steel. — Two chisels in the channelway of the U.S.S. Triana were badly corroded. Prof. Munroe, U.S. N.A. finds this due to electro-chemical action between tempered and untempered steel in presence of salt water. The untempered steel suffered. — (*Proc. U. S. nav. inst.*, viii. no. 3.) C. E. M. [871

ENGINEERING.

Tensions in guns. — Considering the longitudinal and hoop tensions in a thick hollow cylinder, Lieut. Stone, U.S.N., finds that the longitudinal tension is greatest on the outside, and the hoop tension is greatest on the inside, where an assumed distance of a point from the axis of the cylinder coincides with the internal radius. He shows the presence of a neutral surface, within which there is a longitudinal compression, and without, a longitudinal tension. The formula deduced, giving the value of the maximum hoop tension, differs considerably from that heretofore used. The existence of a neutral surface of longitudinal stress is of great interest in the construction of built-up guns. That a longitudinal contraction may accompany a circumferential expansion is a familiar result of experiment. These formulas may be used in calculating the tensions in built-up wire guns. — (*Proc. U. S. nav. inst.*, viii. no. 3.) C. E. M. [872

Lighting buoys and railroad-cars. — The U. S. lighthouse board has placed a Pintsch lighted buoy at the entrance of New-York harbor at the request of the pilot commissioners. The Erie and the West Shore railroads have adopted this method of lighting cars in imitation of German railways. Gas made from coal-oil is stored by compression in reservoirs, and burned in peculiar burners, a regulator being used to preserve the desired pressure. — (*Marine reg.; R. R. gaz.*, April.) R. H. T. [873

Heavy steel guns. — The chief of ordnance has called for information from the steel-makers of the United States, relative to the feasibility of making steel for ordnance, giving analyses of desired qualities. The act of 1883 provides for arming fortifications with steel guns. — (*Bull. iron steel assoc.*, April, 1883.) R. H. T. [874

Standard gauge system. — G. M. Bond, M.E., has described to the American society of mechanical engineers the system of standardizing gauges devised by Prof. Rogers of Harvard, and himself, for the Pratt & Whitney company of Hartford, and the comparator built for that company under their direction for establishing standard gauge measures. A pair of standard inch-measures, worked down independently, were found to be exactly alike, the difference, if any exists, being less than $\frac{1}{355000}$ inch. Bond reports ready for inspection by the committee of the society, a set of end-measures varying by sixteenths of an inch, and a complete plant of tools and fixtures for producing standards, duplicating originals by *machined* work. — (*Journ. Frankl. inst.*, May.) R. H. T. [875

CHEMISTRY.

(*Analytical.*)

Estimation of sulphur in organic bodies. — P. Claësson has perfected a method for the determination of sulphur in organic substances, which seems, from his results, to be capable of remedying the various defects that detract to a greater or less extent from the accuracy of the methods hitherto in use. It consists in burning the substance in a current of nitric dioxide and oxygen, and absorbing the sulphuric acid in a receiver containing water. The sulphuric acid may be determined by titration, or by precipitation as baric sulphate. The substance is placed in an ordinary combustion-tube, and behind it a roll of platinized asbestos. In front of the substance are placed several platinized asbestos rolls, and a small tube containing fuming nitric acid. The combustion is conducted in the usual way, and finally the sulphuric as well as the nitric acid is expelled into the receiver. The author adduces results to show that a dilute solution of sulphuric acid may be evaporated to dryness on the water-bath without appreciable loss of the acid. — (*Zeitschr. anal. chem.*, xxii. 182.) C. F. M. [876

Determination of lactic acid. — R. Palm states that lactic acid is completely precipitated when it is added in aqueous solution to an alcoholic ammoniacal solution of basic plumbic acetate. The plumbic lactate is washed with alcohol, since it is somewhat soluble in water. — (*Zeitschr. anal. chem.*, xxii. 223.) C. F. M. [877

Flow of liquids on the surface of a burette. — In measuring liquids from a burette, Prof. R. B. Warder finds that an error may be introduced by the gradual rise of the meniscus, if the reading is taken too soon after the flow of the liquid is stopped. After a discharge of 60 cc. of a one-eighth normal solution of sodic hydrate, the meniscus continued to rise for ten minutes. — (*Proc. Ohio mech. inst.*, ii. 46.) C. F. M. [878

A new method for the determination of arsenic. — Mr. Richard Pearce, of the Boston and Colorado smelting company, described a method for the quantitative estimation of arsenic, as suggested by himself, and developed by Albert H. Low, chemist of the company. It consists in first fusing the mineral, ore, or furnace-product supposed to contain arsenic, with sodium carbonate and potassium nitrate, ex-

tracting the soluble arseniate with water, acidulating the solution with nitric acid, boiling to expel carbon dioxide, neutralizing carefully with ammonia (the reaction should be faintly alkaline rather than acid), and precipitating the arsenic in the cold with argentic nitrate as the brick-red salt Ag_3AsO_4. The latter is thrown on a filter, washed well, dissolved in nitric acid, and the silver determined by titration with ammonium or potassium sulpho-cyanate, whence the arsenic can readily be calculated. The results communicated showed very remarkable concordance, and apparently a high degree of accuracy. The exact degree of accuracy does not appear; since the percentage of arsenic in some of the substances tested was not determined gravimetrically, but assumed to be that required by theory. By this method, 0.1 gr. of enargite yielded 19.03 and 19.09% arsenic in successive trials. 0.05 gr. pure pronstite gave 15.08% arsenic, while 15.15% is theoretically required. An ore mixture gave respectively, 3.26, 3.30, 3.19, and 3.25% arsenic in different trials. A copper matte yielded 0.47 and 0.46% arsenic in successive determinations. Antimony, the presence of which in solution would vitiate the results of analysis, is almost entirely excluded by the use of sodium carbonate in the fusion. In a mixture of the enargite above tested with stibnite, 19.13% arsenic was found. No experiments were made to test the solvent action of the ammonium nitrate in the solution on the argentic arseniate. The advantages claimed for the method are the great ease and rapidity with which a determination can be made, and the high degree of accuracy attainable, fully sufficient, at least, for technical purposes. — (*Col. sc. soc.; meeting* Feb. 5.) [879

AGRICULTURE.

Action of peat on insoluble phosphates. — In an extensive series of experiments carried out at the Moor experiment-station in Bremen, Fleischer finds that certain peats exert a very considerable solvent action on phosphates. The first experiments were made in the laboratory by intimately mixing finely ground peat and phosphate, adding water, and allowing the mixture to stand, usually for three days. Peat from the lowland moors showed no solvent action; but that from highland moors (sphagnum peat) acted upon the phosphates in every case but two, dissolving from three or four to over fifty per cent of the phosphoric acid present, according to the nature of the phosphatic material. The materials used may be arranged in about the following order, the more soluble first: pure dicalcic phosphate, precipitated tricalcic phosphate, fine raw bone, steamed bone, commercial precipitated phosphates, bone-ash, crude Mejillones guano, Lahn phosphate. The action appears to be due to the presence of free humic acid, which decomposes the phosphates. In several cases the action went so far as to produce free phosphoric acid. Addition of potash-salts was found to increase the solvent action. These results are entirely in harmony with those that have been obtained in field-experiments on these soils. Almost invariably, insoluble phosphates have given better results than soluble ones, the reason evidently being, that, owing to the small absorptive power of peat, the soluble phosphates are soon washed out of the soil, while the insoluble phosphates yield up their phosphoric acid so slowly that the plants can utilize most or all of it. Experiments were also made in composting phosphates and peat. Here, also, phosphoric acid was dissolved, but not to so great an extent as in the laboratory experiments, where a much more intimate mixture of the materials was possible. From 0.6 to 9.2 per cent of the total phosphoric acid was dissolved. Potash salts increased the solubility of the phosphates. A large proportion of the phosphoric acid was rendered soluble in ammonium citrate; that is, brought into a condition similar to that of the so-called reverted phosphoric acid. In connection with these experiments, Kissling has studied the effect of the presence of various salts on the action of peat upon phosphates. Potassium sulphate increased the action decidedly, potassium chloride to a less degree, and sodium nitrate and kainit hardly at all. Gypsum and calcium chloride decreased the solvent action, and potassium carbonate destroyed it altogether, presumably by neutralizing the humic acid of the peat. The effect of the potassium sulphate was found to be almost exactly in proportion to the quantity used. Although the solvent action of peat, and of peat and potash salts, appears to be comparatively slight on the large scale, it is not without importance; since, in the soil, it may continue for a long time, and the products of the reaction may be continually removed by the movements of water in the soil and the action of vegetation. Fleischer found, that, after his mixtures of peat and phosphates were washed out, the action appeared to begin afresh; and something very like this must occur in the soil. — (*Landw. jahrb.*, xii. 129, 193.) H. P. A. [880

GEOLOGY.

The Bow and Belly River districts, North-West territory. — The rocks of the foot-hills and east of the mountains, according to G. M. Dawson, are entirely of cretaceous and Laramie age, overlain by bowlder clay and other beds referable to the glacial epoch. The geology of the region is complicated by the fact, that, in the immediate vicinity of the mountains the beds change considerably in lithological character, the change being such as would be expected to occur on the approach to a shore-line. So far, no reason has been found to suppose that any beds newer than the Laramie (including under this general name the Judith River and Fort Union series) have been found in this district, or, indeed, in any part of the Canadian North-West territory. The general arrangement of the rocks is given in the following table: —

I. Laramie (including Judith River series). — 1. Beds of the Porcupine Hills: massive sandstones, with shales, etc. 2. Willow Creek beds: reddish and purplish clays, with gray and yellowish sandstones. 3. St. Mary River series: sandstone shales and clays of general grayish or grayish-green colors. 4. Yellowish sandstones and shaly beds, with a mingling of fresh-water and brackish or marine mollusks.

II. Fore Hills. — 1. Yellowish sandstones, with some shales, apparently irregular in thickness and character; mollusks all marine.

III. Pierre group. — 1. Blackish and lead-colored shales, with occasional sandstone intercalations, especially toward the mountains.

IV. Niobrara? — Belly River series: sandstones, shales, and sandy clays. Upper part generally grayish; lower, yellowish, and often banded by rapidly alternating beds. Fresh and brackish water mollusks.

Near its base, the Laramie of this region is a persistent lignite or coal-bearing formation. In the Pierre group, the most persistent coal-bearing horizon is at its base, although there is a coal-seam at its summit on Bow River. Mr. Dawson considers the coal-bearing horizon at the base of the Pierre to be nearly equivalent to that at the base of the Chico group, which yields the coals of Vancouver Island at Nanaimo and Comox. (In this connection it is well to remember that the identity of the so-called Chico of Vancouver Island with the group of that name in

California is not by any means established.) The following approximate estimates of the quantity of coal underlying one square mile of country in several localities have been made:—

Main seam, in vicinity of Coal Banks, Belly River, 5,500,000 tons.

Grassy Island, Bow River (continuation of Belly River, main seam), 5,000,000 tons.

Horse-shoe Bend, Bow River, 4,900,000 tons.

Blackfoot Crossing, workable coal in seam as exposed on Bow River, 9,000,000 tons. — (*Geol. surv. Can.*) J. B. M. [881

Triassic traps and sandstones. — Mr. W. M. Davis last summer visited a number of localities in Massachusetts, Connecticut, and New Jersey, for the purpose of studying the relation of the trap masses to the triassic sandstones and shales. Some of these are dikes traversing the strata at high angles, and about such there has been comparatively little conflict of opinion. But the greater number exist as sheets conforming to the bedding; and these have been regarded by some writers as contemporaneous, by others as intrusive. Mr. Davis finds distinct evidence that some of the sheets were extravasated during the deposition of the strata, being afterward buried as the sedimentation progressed; and he finds equally distinct evidence that other sheets were injected between sedimentary layers already formed, and cooled under pressure. To the first class belong the principal masses of the Connecticut valley, including Deerfield Mountain, Mounts Tom and Holyoke, and the Hanging Hills near Meriden; to the second, belong the East and West Rocks near New Haven, and the Palisades of the Hudson. The principal intrusive masses occur in what are regarded as the lower portions of the formation, and may have been injected while the upper strata were still in process of formation.

A duplication of trap-ridges by faulting is demonstrated in some instances, and suspected in others; and it is pointed out that these faults may belong to a wide system, whose total effect is greatly to expand the outcrop of the formation by duplication. Each of the greater triassic districts presents a wide expanse of strata, with a prevailing dip at a considerable angle in one direction. To account for the phenomena by tilting alone, assumes an amount of deposition and subsequent erosion appalling even to the geologist; while the erosion demanded by the hypothesis of tilting and faulting combined is readily admissible.

The observations are prefaced by a bibliography of the subject, and followed by a general discussion, which includes an excellent digest of the opinions and observations of earlier writers. The paper makes a pamphlet of sixty octavo pages, illustrated by three plates. — (*Bull. mus. comp. zoöl., geol. ser.*, i., no. ix.) G. K. G. [882

Ore-deposition by replacement. — As a result of his geological studies in Leadville, Col., Mr. S. F. Emmons has reached the conclusion that the 'carbonate deposits' of that locality were not formed by the filling of pre-existent cavities. They belong to a class of deposits for which he proposes the name *metamorphic*, and which are produced by a metasomatic interchange between exotic matter and original rock material. In Leadville the original rock is a dolomitic limestone, 150 to 200 feet thick; and the replacement has occurred either at or near its contact with an overlying sheet of porphyry. The introduced or vein material consists of silica and metallic minerals. These were brought in solution by percolating waters, having been previously dissolved from the associated eruptive rocks. In places the whole bed of limestone has been replaced, but in general only a portion. The equivalent vein occupies less space than the limestone; but, allowing for this difference, the thickness of vein and the thickness of residual limestone are complementary.

Mr. Emmons regards the class of metamorphic deposits as an extensive one, including a large proportion of the so-called fissure-veins, both calcareous and siliceous, of the Rocky Mountain region. — (*Phil. soc. Wash.; meeting* April 7). [883

MINERALOGY.

Products of the alteration of corundum. — The following are the results of observations made by F. A. Genth:—

Alteration into spinel. — At the Charter mine, Madison County, N.C., corundum occurs crystallized, and in cleavage masses of a grayish or white color. In the cracks of the same it can be noticed that a change has taken place; and in many cases this extends through large masses, converting the corundum into a massive greenish-black spinel, rarely showing octahedral crystals. The same has a gravity of 3.751. Scales of prochlorite, into which the mineral finally passes, are often present. Analysis of the carefully selected material indicates that it has the composition of a spinel.

Alteration into zoisite. — At Towns County, Ga., pink crystals of corundum are found, surrounded by greenish-white cleavable zoisite.

Alteration into felspar and mica. — The author cites many occurrences in which cleavable masses of oligoclase and albite surround a core of undecomposed corundum, also where the corundum is surrounded by flat, cleavable mica (muscovite) or a delicate fibrous mica (damourite). Sometimes the mica and felspar occur together; and the nucleus of undecomposed corundum appears on its exterior very rough, as if it had been eaten into. Numerous analyses are given to prove the identity of the decomposition products.

Alteration into margarite. — This occurs more seldom than the alteration into potash mica; and in some cases scales of the latter are interposed between the margarite, which usually is compact in its nature. Specimens showing this alteration are from Jackson and Iredell counties, N.C., and from Unionville and Aston township, Penn.

Alteration into fibrolite. — Specimens from near Norwich, Conn., and Burke county, N.C., show radiated fibrolite surrounding crystals of unaltered corundum. It seems as if, in many cases, the fibrolite had undergone a subsequent change into mica.

Alteration into cyanite. — At Iredell and Wilkes counties, N.C., bladed cyanite is found surrounding, and evidently resulting from, the alteration of corundum. From the latter locality the cyanite has partially undergone a change into micaceous minerals. — (*Proc. Amer. phil. soc. Philad.*, xx. 381.) S. L. P. [884

GEOGRAPHY.

(Arctic.)

Geographical notes from the north. — The record of the Eira expedition appears in the *Monthly record of geography* for April, giving an account of the voyage up to Aug. 21, 1881, when the vessel was pierced by the ice, and the subsequent proceedings of the party until their rescue during the following summer. Even during the arctic winter, warm southerly gales occurred, which resulted in limited areas of open water. —— Prof. Nordenskiöld's expedition will

sail some time during May, and will attempt a journey eastward over the ice from Auleitsivik fiord, in lat. 68° 30′, near Egedesminde. Later an attempt may be made to penetrate northward along the south-eastern coast. —— No new information has been obtained from the remainder of the Jeannette survivors, recently examined by the Naval board. —— In a recent lecture, Mr. E. H. Hall stated that the population of Newfoundland and Labrador amounts to 190,000, about one-quarter of whom subsist by the fisheries, which are valued at four and a half millions of dollars annually. The copper-mines produce about 45,000 tons of metal annually. —— A hurricane in British Columbia recently destroyed four vessels in Victoria harbor, and was attended with some loss of life. —— The fur-seal fishery off Cape Flattery has been very productive this season, over 20,000 seals having been secured. —— The Newfoundland hair-seal fishery has also been remarkably successful, more than 200,000 hooded and harp seal being reported taken. On the other hand, the Dundee fleet, in the same waters, is said to have made a poor catch. —— Ensign Stoney, U.S.N., will sail early in May in the revenue-cutter Corwin to distribute the presents from the government to the Chukchis, of St. Lawrence Bay, Bering Strait, who succored the crew of the U.S. S. Rodgers, which was burned in that bay while searching for the Jeannette party. —— The growing scarcity of salmon for canning, in the Columbia River and southward, has led those interested to push into the undepleted waters northward. Several new fisheries have been established on the Skeena River, and others on the Chilkat River, and even in Cook's Inlet, nearly to latitude 60° N. —— Four steam-whalers, built on the Pacific coast, will join the Bering Strait fleet this season. They are fitted with all the latest improvements, including iron tanks for oil and blubber, and are appropriately named the Orca, Bowhead, Narwhal, and Balaena. —— It has been a very open season in Alaska, and in the south-eastern portion the snow was reported nearly gone March 25. —— The aboriginal inhabitants of middle and northern Siberia, especially the Ostiaks and Samoyeds, are apparently either at a standstill, or even decreasing in numbers. According to recent investigations of Yadrintseff, their situation is precarious; and that they should gradually die out, as seems inevitable, is the more unfortunate, since many of them possess much intelligence and numerous good qualities. —— In *Petermann's mittheilungen* for April, Dr. Rink describes the investigations of the Danes in Greenland during recent years, in mineralogy, geology, geography, botany, and archeology, and gives a geological map of the west coast between Disco and Pröven. — W. H. D. [885

(South America.)

Chilian province Arauco. — A physical sketch of this province, by J. Sieveking, divides it into the littoral slope, the coast or Nahuelbuta range, the central plain, and the great Cordillera. The Nahuelbuta range extends north-north-west to south-south-east, and reaches an elevation of 5,000 feet. Its rocks are granite and crystalline schists, broken by basalt eruptions, and furnish gold to the streams. The auriferous gravels gave a rich yield to the early Spaniards, who forced the Indians to work them; but the latter rebelled, and drove away their would-be masters. In late years gold-washing has been again attempted with moderate success. Between the mountains and the coast is a hilly country, some twenty miles wide, rising to 1,000 feet elevation. It consists of Jurassic and later conglomerates and sandstones, which enclose valuable coal-beds, three to nine feet thick, with a low percentage (two and a half) of ash. In Arauco little mining-work has yet been done: but, in the adjoining province on the north, the output reaches 10,000 tons a month; and with the rapid increase of steam-navigation along the western coast, of railroads in the interior, and of smelting and saltpetre works in the north, where fuel is scarce, this product must grow rapidly. The author believes the coal to be Jurassic, and not tertiary, as it has been described. All the coast range and littoral slope are heavily wooded, the climate rough and wet, especially in winter; the streams are short and not navigable, and, on nearing the coast, they cross a low plain of recent elevation. The harbors are open to the north-west, but closed on the south-west by the extension of sand-bars built up by the heavy waves and strong northward current. The central plain proves well adapted to agriculture and grazing at the few points where it has been settled; but the greater part is still unoccupied, except by the Araucanians, who maintain possession of a considerable share of good land in the south. Little is known of the Cordillera (it has hardly been entered), as winter begins early there with heavy snow-storms. The stones brought down by its streams are nearly all porphyritic, and sedimentary rocks are quite absent. There are two volcanoes on the range, — Antuco, which Pöppig found active; and Villarica, near the lake of the same name. — (*Peterm. mitth.*, 1883, 57.) W. M. D. [886

(Africa.)

Lake Moeris. — Another of the stories of Herodotus seems to be gaining ground. In 1871 Rousseau-Bey found, by levelling, that the present lake, Birket-el-Kerun, in the Fayum (cf. Schweinfurth, *Zeitschr. f. erdk. Berlin*, xv. 1880, 152, map), is at surface and bottom 41 and 55 met. respectively below the Mediterranean, and that its former level was 10 met. above the same datum, giving an original depth of 65 met. and a greatly extended area. Comparing this with the description of the 'Meridis lacus,' given by Herodotus, Mr. F. C. Whitehouse was confirmed in his trust of the old geographer, and, after some preliminary excursions, set out from Cairo early in 1882, and succeeded in finding by aneroid measurement a considerable depression south of Birket-el-Kerun, with its lowest point 180 feet below the Mediterranean, separated from the northern basin by a low divide (gisr), that seemed decidedly below the level of the Nile in this latitude. The southern end of this depression was not visited; but, as now mapped, the entire basin, if flooded from the Nile, might approach the area, and reach the depth, given for it by Herodotus, although his description has generally been discredited, along with his assertion that it is 'manifestly artificial.' But this, also, Mr. Whitehouse seems to accept, as he speaks of the basin as a 'victory of mind over matter,' and suggests that we should treat the Mississippi as the Egyptians did the Nile. This conclusion, and the severely critical animus shown towards earlier writers, are the less satisfactory parts of the paper, which, in its evidence of work, its review of the cartography of the Fayum, and its quotations concerning Lake Moeris from ancient authors, contains much of interest. — (*Bull. Amer. geogr. soc.*, 1882, 85, map.) W. M. D. [887

Southern Abyssinia. — P. Soleillet writes from Ankober, Nov. 10, 1882, that he had made good progress, and obtained from King Menelik valuable concessions for the commercial company that he represents. A vast agricultural territory was open to their occupation and cultivation. Olive-forests were found to be very extensive: their fruit might be

improved by grafting, and the company was conceded half of the yield for the next twenty-five years. Permission was given to lay a narrow-gauge railroad from Obok, at the head of the Gulf of Aden, past lake Aussa, to Shoa, following up the left bank of the 'Ouache' (Hawash), where the construction would be easy and cheap. — (*Comptes rendus soc. geogr. Paris*, 1883, 36.) (The road projected would be at least two hundred miles long, and partly in a very unproductive country; so that, in spite of the present activity of African development, this project can hardly expect an early completion.) — W. M. D. [888

(*Atlantic Ocean.*)

The Faraday Hills. — Dr. O. Krümmel has discussed the Atlantic soundings published by the Siemens Brothers (see 439), and shows that the Faraday Hills (about lat. 50° N., long. 30° W.) are very probably formed by submarine volcanic eruption. The soundings are so numerous and exact, that a trustworthy profile across the hills is constructed, exhibiting their surprisingly steep slopes (13 to 17° on one side, and 35 to 25° on the other), and revealing them as a mass about six miles broad at the base, rising from a bottom 1,300 to 1,700 fathoms deep to a summit about a mile broad in a minimum depth of 630 fathoms. Their form is therefore truly volcanic, and their altitude approaches six thousand feet. They are of rocky or stony surface, and have no ooze characteristic of deep-sea bottoms. The Flemish cape on the eastern slope of the Newfoundland banks is also stony, but this is regarded as a deposit of drift from melting icebergs. — (*Ann. hydrog.*, 1883, 5, 146.) W. M. D. [889

The Triton in the North Atlantic. — A sounding expedition on the British steamer Triton, under direction of Mr. Murray, formerly geologist on the Challenger, spent about a month in August and September last in exploring the Atlantic from the Shetland to the Faroe Islands, where, according to previous explorations, a shallowing of the bottom, named the 'Wyville-Thomson ridge,' separated the deep cold water on the north at 32° F. from the warmer bottom-water on the south at 47° F. In the northern part of the ridge, a depression was found with a depth a little over three hundred fathoms, through which some of the arctic water may pass southward. The shallower parts of the ridge, with a minimum depth of two hundred and sixty fathoms, is covered only with gravel and stones, and some of the latter showed distinct traces of glacial action. The fragments are of sandstone, diorite, mica-schist, gneiss, limestone, etc. Several new species were added to the faunae of the warm and cold areas first described in the results of the Lightning and Porcupine expeditions in 1868, 1869. — (*Ann. hydrog.*, 1883, 194.) W. M. D. [890

BOTANY.

(*Physiological.*)

Extravasation of water from leaves. — This interesting phenomenon has been carefully examined by Volkens, who, while adding little that is really new, has shown the relations of the water-pores to the underlying tissues in a large number of families. It may be said, that, with three exceptions, the points of secretion were confined, in all cases examined, to the upper side of the leaf. The places are always distinguished by color, swelling, or some equally well-marked indication. The number of the pores is typical in many families and sections. — (*Jahrb. bot. gart. Berlin*, 1883, 167.) G. L. G. [891

Continuity of protoplasm in contiguous cells. — Hillhouse's method is a modification of Sachs's, and consists in using dilute sulphuric acid on thin sections, following this by concentrated acid for several hours, thoroughly washing with water, and finally staining with ammonia-carmine. By this means it is possible to break down cell-wall without disturbing the protoplasmic threads. A similar process was used by Gardiner in his study of Mimosa. — (*Bot. centralbl.*, xvi. 1883.) G. L. G. [892

Variable dichogamy. — Though as a general rule the Indian corn (Zea) appears to be imperfectly protandrous, — beginning to shed its pollen one or more days before the stigmas of the same plant are developed, but continuing the process for several days afterward, — in no small number of instances the dichogamy is reversed, so that the plant is strongly protogynous, while it is sometimes synacmic, — staminate and pistillate flowers maturing at the same time. This, with the similar behavior of the perfect flowers of certain species of Ribes, notably the golden currant, shows pretty clearly how either sort of dichogamy may have originated in what were at first synacmic species. — (*Rural New-Yorker*, April 14.) W. T. [893

Self-impotence of red clover. — For six years Prof. Beal has been experimenting on the fruitfulness of Trifolium pratense, when self-pollinated and when crossed by humble-bees. Though the results obtained in the several years differ greatly, — from absolute self-sterility to the production of two-thirds as many seeds as by crossing, — they agree in showing a marked increase of seed where bees have worked. A source of error which tends to diminish the apparent value of crossing is the impossibility of excluding species of Thrips and other small insects by means of the netting used to cover the plants for the exclusion of bees, so that it is probable the degree of self-impotence is greater than appears from these experiments. The general results may be gathered from the appended table of ratios: —

	Bees excluded.	Bees admitted.
First year	66.6	100
Second year	63.5	100
Third year	First crop, 1.3	100
	Second " 0.0	100 (0 : 337).
Fourth year	Not counted ac-	curately (0 : many).
Fifth year	1.2	100
Sixth year	27.2	100
Average	26.6	100

— (*Rep. bot., Mich. agric. coll.*, 1881–82; *Amer. agric.*, Jan.) W. T. [894

(*Systematic.*)

Flora of Madagascar. — The most important novelties among the Polypetalae of recent English collections in Madagascar are described by Mr. J. G. Baker, including about 135 species. The woody character of the vegetation is remarkable, as shown by this list, in which are 40 trees, and 64 shrubs and woody climbers, against 31 mainly herbaceous perennials and annuals. — (*Journ. Linn. soc. Lond.*, March, 1883.) S. W. [895

New Bermuda plants. — The flora of the Bermudas, like that of the Azores, is remarkable for the almost complete absence of endemic species. With the exception, perhaps, of the palms, as yet imperfectly known, the only peculiar plants are two that have been recently described by Mr. Hemsley, and

these may yet be found to occur in the West Indies, or on the mainland. One is Erigeron Darrellianus, with the habit and foliage of Conyza rivularis; the other, Statice Lefroyi, hitherto identified as S. Caroliniana. — (*Journn. bot.*, April, 1883.) S. W. [896

ZOÖLOGY.

Mollusks.

The position of Rhodope. — The views of Graff (*Morph. jahrb.*, viii. i.), referring Rhodope to the nudibranchiate mollusks, have received such wide publicity that it is well, even if a little late, that the views on this topic of the most eminent living student of the nudibranchs should have a hearing. R. Bergh of Copenhagen has examined Rhodope with special reference to the views of Graff, and finds, notwithstanding the fact that it is separated by marked characters from the ordinary turbellarians, that the differences between it and the nudibranchiate gastropod mollusks are much greater. There are no nudibranchs destitute of a heart, or of an organ filling the office of a kidney. Few have the liver reduced to a single mass. The genital organs of Rhodope do not differ greatly from those of turbellarians. The form and armature of the tail resemble those of many turbellarians, and nothing similar is known among the nudibranchs. Certain resemblances assumed to exist between the nervous system in Rhodope and Tethys, on the basis of Ihering's figure of the latter, have no force, since it appears that the figure is inaccurate. Lastly, a quietus is placed upon the theory by the fact that the larva of Rhodope has neither larval shell nor velum, which are universal in nudibranchs. It is therefore certain that Rhodope is no nudibranch, and eminently probable that it is nothing more than a peculiarly aberrant turbellarian. — (*Zool. anz.*, 123.) W. H. D. [897

Fischer's Manuel de conchyliologie. — Part fifth of this excellent work is at hand, comprising pp. 417–512, which carry it forward from the Ascoceratidae, concluding the Cephalopods, through the Pteropods, and nearly through the order Pulmonata in the class of Gastropoda. The latter is divided as follows: —

Class GASTROPODA.

Subclass UNIVALVIA	Androgyna	Order	*Pulmonata.*
			Opisthobranchiata.
	Dioica	Heteropoda .	*Nucleobranchiata.*
		Platypoda . .	*Prosobranchiata.*
Subclass MULTIVALVIA	. . . .		*Polyplacophora.*

The author's paleontological researches have enabled him to preserve a satisfactory equilibrium as regards living and extinct forms. Numerous new and characteristic figures appear in the text, in addition to others not unfamiliar in the pages of Woodward; and with this fasciculus is added an atlas of twenty-four plates, which originally appeared in Woodward's Manual, and are well known, but which have never been excelled in clearness and accuracy by any purely black and white conchological plates issued up to the present time. The most casual inspection of the text, however, will show that we are presented with something quite different from a merely revised edition of Woodward, and that the volume when completed, though doubtless open to criticism in some of its details, will be by far the best text-book of the subject available. — W. H. D. [898

Anatomy of Parmacella. — H. Simroth devotes a paper of forty-six pages, with an excellent plate, to the elucidation of the anatomy of P. Olivieri Cuvier. Its features are compared in detail with homologous organs in other pulmonates; and among his deductions the author concludes that the slugs constitute the highest evolution-product of the group of Pulmonata (a view in which he was long preceded by A. A. Gould and others), and that Parmacella, in particular, exhibits closer relations with the Patula-section of Helicidae than with the group including Vitrina, etc., with which some other slugs are most closely allied. — (*Jahrb. deutsch. mal. gesellsch.*, i. 1883.) W. H. D. [899

Curious slug from Madagascar. — Heynemann describes under the name of Elisa bella a curious slug allied to Amalia, with a spatulate internal shell, dorsal keel, four retractile tentacles, a jaw resembling that of Limax, radula like Helix, and a terminal slime-gland accentuated by a short deep groove extending backward on each side from it. It is in the Senckenbergian collection. — (*Jahrb. deutsch. mal. gesellsch.*, i. 1883.) W. H. D. [900

Crustaceans.

Metamorphosis of Penaeus. — Walter Faxon calls attention to the fact that Fritz Müller did not keep the supposed Penaeus nauplius under observation until it changed to a protozoea, as is stated by W. K. Brooks in his recent account of the metamorphosis of Penaeus (*Johns Hopk. univ. circ.*, Nov., 1882), and that, consequently, the rearing of the protozoea to the young Penaeus by Brooks proves nothing new in regard to the relation of Müller's nauplius to Penaeus. Faxon, however, sees no good ground for refusing to accept Müller's reasons for believing his nauplius and zoea stages to be parts of one life-history. — (*Amer. nat.*, May, 1883.) S. I. S. [901

Copepoda living in mollusks and ascidians. — C. W. S. Aurivillius has investigated the Copepoda inhabiting mollusks and ascidians on the Swedish coast, and published the results in two papers illustrated with seven double plates. Only two species, both belonging to the Sapphirinidae, were found inhabiting mollusks, — a species of Lichomolgus on species of Doris, and a new genus and species (Modiolicola insignis) upon the branchiae of Modiola and Mytilus. Twenty-one species, representing seven genera and five families, were found in the branchial sacs of ascidians, two new species being added to those already described by Thorell and others. Nearly all the old species are redescribed, and a large part of them figured, and analytical tables of the genera and species given. — (*Ofvers. vet. akad. förh.*, 1882, Nos. 3 and 8.) S. I. S. [902

Insects.

Life-histories of American butterflies. — W. H. Edwards continues his careful and valuable descriptions of the early stages and habits of different American butterflies, giving us lately those of Grapta comma, G. interrogationis, and Pyrameis Atalanta. The descriptions of the caterpillars lose part of their value through lack of sufficiently explicit statement of the precise location of the dermal appendages. — (*Can. ent.*, xiv. 189, 201, 229; xv. 14.) [903

Natural history of the fig-insects. — The very singular little group of fig-dwelling hymenoptera, referred by Westwood to the Chalcididae, is the subject of a recent monograph by Dr. Paul Mayer. Fig-growers have for ages taken advantage of the habits of Blastophaga grossorum for cross-fertilizing the tame fig with the wild caprificus. Mayer describes the anatomy of this species and some others, and discusses the geographical distribution of all known species, and their relations to the species of Ficus and its allies. The amount of adaptation induced by the peculiar habitat of the fig-insects varies in different

genera, the least abnormal forms being South American. The two sexes often differ enormously; the male of some forms losing wings, mouth, and ocelli, and having eyes and antennae of small size. — (*Mittheil. zool. stat. Neapel*, iii. 551, pl.) E. B. [904

(*Economic entomology.*)

The pine moth of Nantucket. — Detailed accounts of the different stages, except the egg, and of the habits of Retinia frustrana Scudd., are given by S. H. Scudder. The paper is illustrated by an excellent chromolithographic plate. The author is inclined to believe the insect described under the same name by Comstock (*Rep. U. S. dep. agric.*, 1879) is specifically distinct. — (*Pub. Mass. soc. prom. agric.*, 1883.) J. H. C. [905

The spruce Tortrix. — The natural history of Tortrix fumiferana Clem. is given by C. H. Fernald. (*Ann. rep. st. coll. agric. Maine*, 1882.) J. H. C. [906

Clothes-moths. — A careful revision of the three species of Tinea which infest clothing has been made by Fernald. The common case-making species should be known by the name of Tinea pellionella Linn; the species which makes a gallery of the substance on which it occurs is Tinea tapetzella Linn; and the third species, which does not make a larval case, but webs together portions of the substance upon which it feeds into a cocoon before changing to a pupa, is Tinea bisselliella Hum. — (*Ann. rep. st. coll. agric. Maine*, 1882.) J. H. C. [907

VERTEBRATES.

(*Physiology.*)

Development of the red blood-corpuscles. — Feuerstack has published a memoir on this subject. He gives first a brief mention of those authors who have sought to trace the development of the red corpuscles from the white; second, an abstract of Hayem and Pouchet's theory of the haemato blasten; third, of other views of less importance. The author then presents his own observations and conclusions. "We find in the circulation of animals with nucleated blood-corpuscles every possible transition between colorless and colored blood-corpuscles. That they are transition stages from the white to the colored cells is shown by the course of development during artificially induced blood-formation." The principal places of formation in the pigeon are the osseous medulla, the spleen, the portal system, and the feather-shafts; in the frog, the bony medulla and spleen; in Triton, the spleen, and the lymph sinus near the bladder; in the eel, the spleen and the venal lymph sinus. (The author has overlooked the view, which is the one most plausible to us, that the colored corpuscles are merely nuclei, and not complete cells. His observations seem far from having settled the problem.) — (*Zeitschr. wiss. zool.*, xxxviii. 136.) C. S. M. [908

Structural changes in the liver, accompanying functional activity. — This subject, which as yet has been little worked at in comparison with the numerous corresponding researches made on other glands of late years, is the subject of an interesting research by Afanassiew. His work leads him to the following conclusions: 1°. Both glycogeny and the formation of bile take place in all the cells of a liver-lobule. 2°. Agencies (section of the liver-nerves or feeding on albuminous diet) which increase the secretion of bile bring about a marked increase in the size of the hepatic cells, which are also seen to contain, in the interspaces of their protoplasmic network, numerous albuminous granules. The cell limits are distinct, and the nuclei large and granular; the whole organ is firm and resistant. 3°. On feeding so as to get a liver exceptionally rich in glycogen, the cells are found to be enormously large, when compared with those of an unfed animal, their contours sharp, and in the cell body so many amorphous glycogen particles deposited as to compress the proper cell-substance into a mere coarse network stretching from the nucleus towards the periphery. The blood-capillaries are considerably narrowed by compression from the neighboring cells. The whole liver is soft and brittle. 4°. Toluyl-di-amine, which had been found by Schmiedeberg to produce jaundice, causes an increased biliary secretion. This it does by bringing about a great destruction of red blood-corpuscles, whose decomposition products stimulate the liver, and provide material for increased gall-secretion. The experiments were made on dogs. — (*Pflüg. archiv*, xxx. 385.) H. N. M. [909

ANTHROPOLOGY.

Ethnography of the Caucasus. — In a summary of work by the Russian geographical society, *Nature* has the following language: "Several linguists consider the Armenian language as decidedly belonging to the Iranian group, while others classify it with the European group. Lagarde distinguishes it in three elements, — the Haikan, the Arkasid, and the Sassanid elements. The two latter are Iranian; but the Haikan elements belong to a family of languages the oldest of which is the Zend. Hülschman concludes that it occupies an intermediate place between the Iranian languages and the Slavo-Lithuanian; and Fr. Müller, a partisan of its Iranian origin, admits that it has some kinship with the Slavo-Lithuanian languages. Prof. Patkanoff concludes that it occupies an intermediate place between these two, and is a representative of an extinct group of Indo-European languages, which formerly was spread, perhaps, in Asia Minor." — (*Nature*, March 15.) J. W. P. [910

Tribes of the Zambesi. — Père Depelchin, leader of the catholic mission on the Zambesi, reports the following tribes along that river, near its confluence with the Chobe: the Ma-Nansá (or Ma-Kalaka), Ma-Laya, Ma-Shukulombwe, Ma-Shubia, Ma-Totala (identified with the Ba-Nyeti), Ba-Rotse (or Ma-Rotse), Ma-Ntchoia, Ma-Mbunda, Ba-Libale, Ma-Pingula, Ma-Hes. These tribes are subject to the empire of the Ba-Rotse. Père Depelchin finds that in Holub's lists the vernacular terms for professions had been entered as the names of separate tribes. The traveller also corrects some difficulties respecting the languages of the tribes. — (*Precis hist.*, Feb.) J. W. P. [911

Iron in the Ohio mounds. — Mr. F. W. Putnam showed that the iron swords, and plate of cast iron, referred to in the writings of Dr. Hildreth and Mr. Atwater as found in mounds at Marietta and Circleville, never existed. The light shed by recent discoveries showed that the supposed sword-handle mentioned by Mr. Atwater, and the supposed ornaments of a scabbard described by Dr. Hildreth, were common forms of implements and ornaments from the mounds; while 'the iron rust in the copper tube,' or supposed 'end of the scabbard,' was red oxide of copper, and the tube itself was simply a copper bead of ordinary form. Mr. Putnam had studied the original specimens of Dr. Hildreth, which were in the cabinet of the Antiquarian society; and they will be illustrated in his paper, to be printed by the society. — (*Amer. antiq. soc.; meeting* April 25.) [912

Voyages of Moncatch-Apé. — In reference to the recent notice of M. Le Page du Pratz (see **634**).

and the bearded men on the Pacific coast in the beginning of the last century, Mr. A. M. F. Davis concedes the probability of the journey, but doubts the meeting with the bearded men. Although this region was not penetrated by explorers until Lewis and Clark crossed the continent in 1804, still the stories of the Indians bore uniform testimony to the river and the ocean; and there was more or less testimony tending to show the visitations of white men in ships. Such sources of information were open to Indian and Frenchman alike; and Mr. Davis attempts to show, that, upon the skeleton of the story of actual travel furnished by the Indian, Le Page du Pratz builds up the story, which he publishes with its details, as to the bearded men. He finds two endings to the story, — one published in Dumont; the other, in Le Page's own book, — both credited to Le Page. In the later publication of the two, Mr. Davis fancies that he can trace in the changes evidence of knowledge derived from the Bering's expedition, and from publications of the period, which were given to the world about that time. In conclusion, he hopes that no opportunity will be lost to search oriental records, for upon them we must ultimately rely for the permanent disposal of such questions. — (*Amer. antiq. soc.; meeting* April 25.) [913

Indians on the Beni River. — The Beni River has been explored from time to time: for instance, by Palacios and by Bursa in 1846, by Lieut. Gibbon in 1852, by Prof. Orton and Ivon D. Heath in 1877, and by the Cura Serabia in 1879. Dr. Heath gives the following note on shirt-making: "Some of the men took time, while stopping for breakfast, to make new shirts. A young Brazilnut-tree of the proper size being found, the bark is stripped off to a height of eight to ten feet. This is taken to the river, placed on a log or stone, and beaten with a stick. When free from outer bark, the fibres are opened, and form a good cloth. This is then folded in the middle, a space left for the arms, the sides sewed down to near the bottom, and a slit cut for the head. When old, these shirts are as soft as old linen." In the journey down the Beni River, Mr. Heath encountered the Tacanas, Cavinas, Pacavaras, Araunas, and Mobimas. The most interesting result of Dr. Heath's anthropological researches is the account of a series of pictographs on the rocks at the falls and rapids of the rivers Madeira and Mamoré. Illustrations of these carvings are given. — (*Bull. Amer. geogr. soc.*, 1882, no. 3.) J. W. P. [914

Nomenclature of crime. — In a pamphlet by F. H. and W. B. Wines upon the nomenclature of crimes in the United States as an aid to the tabulation of the statistics of crime, the authors have endeavored to collate all offences punishable in the United States under any statute enacted either by the national congress, or by the legislature of any one of the states. Without a knowledge of the laws under which commitments to prison are made in the several states, the statistics of imprisonment are valueless for all purposes of intelligent comparison. The offences enumerated are divided into five classes, as follows: —

I. Offences against the government. 1. Against the existence of the government; 2. Against the operations of the government, — *a*. Currency, *b*. Election laws, *c*. Postal laws, *d*. Revenue; 3. Against international comity.

II. Offences against society. 1. Against public health; 2. Against public justice; 3. Against public morals; 4. Against public peace; 5. Against public policy.

III. Offences against the person.

IV. Offences against property.

V. Offences on the high seas.

The index to this pamphlet covers 59 pages, and is a necessary guide to the contents of the work. — J. W. P. [915

The archeology of the District of Columbia. — Dr. J. Meredith Toner, in 1874, founded a medal in Georgetown college, D.C., "to encourage among the students habits of inquiry, and the development of the faculty of close and accurate observation, not only of the rarer phenomena of nature, but of the commonest things met with in daily life." At the commencement in 1882, the successful candidate was Louis A. Kengla, who prepared an essay, now printed under the title of 'Contributions to the archeology of the District of Columbia.' The young author enters minutely into localities and classes of implements, and has furnished a good map and five full-page plates of illustrations. The work does credit alike to the writer and to his generous patron. — J. W. P. [916

Natives of Borneo. — Some addition to our knowledge of the inhabitants of Borneo and the Sulu Islands is made by Mr. W. B. Preyer, the British North-Borneo company's resident, at Elopura. The inhabitants of the Sulu Islands are divided into Sulus (Malays, with Arab and Chinese blood) and Bajaws, or sea-gypsies. These are described at length, both as to their physical and their moral characteristics. On the coast-line of Borneo is an extraordinary mixture of people, — Sun-Dyaks, Malays, Javanese, Sulus, Bajaws, Bugis, Chinese, Arabs, Klings, and many others; while of the Buludupies, the indigenous inhabitants of the district, there are hardly any of pure blood left. Allusions are made to slavery, religion, marriage, head-hunting, 'summing-up,' and disease. Mr. Preyer tells a very good story about marriage among the Datos. When a Dato of any consequence marries, he settles upon his bride a dowry of so many slaves, male and female, so many pieces of T. cloth, of silks, chintzes, and sarongs, etc. A house is built for her, and she is settled comfortably. At the end of a few months, the Dato goes off elsewhere, and repeats the process. The abandoned wife goes to work, with her capital and her slaves, to better her condition. Some fine day the Dato sails back to find in every port a house, a wife, and surroundings all comfortable and ready. — (*Proc. roy. geogr. soc.*, Feb. 7.) J. W. P. [917

EGYPTOLOGY.

Serbonis. — In "The Hebrew migration from Egypt, an historical account of the Exodus, based on a critical examination of the Hebrew records and traditions," by J. Baker Greene, second edition (London, Trübner & Co., 1883), on p. 69, we are told, "In ancient times, if we may trust the evidence of historians, a sheet of water existed on the south side of Mount Casius, and separated by a well-defined but narrow strip of land from the Mediterranean Sea. . . . This was the Serbonian Lake. . . . This lake no longer exists. It has been filled by the drifting sands of the adjoining desert." In a work that makes so much pretension to impartiality and search for truth, egregious errors like this ought to be shunned. The best map yet published of Egypt and the Isthmus of Suez (that in Napoleon's Description de l'Égypte, Paris, 1809–1828) gives the length of Serbonis as a hundred kilometres, and its usual width as eight to ten kilometres. Mr. Greville Chester, in the volume of Special papers issued by the Palestine exploration fund, 1881, has given a very full description of the

lake, with its bright, sparkling waters, free from marine vegetation of any sort.

Mr. Greene also says (p. 76), "The evidence of travellers does not, however, support the suggestion that the Red Sea is remarkable for an excessive supply of seaweed." From Ehrenberg, 'Die korallenbänke,' 1832, to the last and best authority on the Red Sea (Klunziger, Upper Egypt, 1878, pp. 345–376), we are assured of the direct contrary of Mr. Greene's assertion. "A celebrated plant is the shora (Avicennia officinalis), which forms large, dense groves in the sea, these being laid bare only at very low ebb. . . . The sea-grass meadows (*gisua* of the Arabs), which we have already often mentioned, and which are met with partly in depressions in the surface of the reef, partly on the bottom of the sea (especially in harbors), afford concealment to a special class of fishes, many of which are distinguished by possessing a green color." — (*Klunziger*, pp. 240, 376.) H. O. [918

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Boston society of natural history.

The collection of minerals. — The society has just finished the arrangement of its collection of minerals with the express purpose of offering it as an illustration of the mode of arrangement to be adopted throughout their museum. The curator's report, shortly to be printed, has a detailed account of the collection, from which we give the following account: —

The exhibition is divided into three parts: I. Comparative mineralogy; II. Synopsis of classification; III. Systematic collection.

I. Under the head of comparative mineralogy, the following topics are treated by means of series of specimens: 1°. Composition and chemical relations of minerals; 2°. Form and structure of minerals; crystallography; 3°. Physical properties of minerals.

1°. Under the first head, such subdivisions as the variation of minerals in composition are dealt with in the cases by the exhibition of several selected series, — (*a*) variations due to original mixtures; (*b*) variations due to decomposition and alteration; (*c*) variations due to chemical substitution. The first (*a*) of these sub-topics, for example, is exhibited in a series of seven minerals. Three of these are varieties of amphibole, and display the distinct colors and aspect due to changes in the chemical composition of the varieties. The second (*b*) is shown by five minerals, among which are orthoclase and wernerite, — quite distinct substances, but which are undergoing reduction by decomposition to the same mineral, kaolinite. In the third (*c*) only one substance, phyrrhotite, and its elements, sulphur and iron (which are placed together upon one tablet), is set apart for the exposition of the differences which may exist between the elementary constituents of a mineral, and the compounds resulting from their union.

The relations of water in the composition of minerals is dealt with in a series running from a strictly anhydrous hematite to natron (hydr. carb. sodium), having 55 per cent of water. There are twelve specimens in this series, and behind each specimen a tube exhibits the relative proportion of water.

2°. Form and structure presented no very serious difficulties beyond the need of finding persons capable of making the special models which were required. This was satisfactorily accomplished after some delay.

3°. As examples of the methods pursued in illustrating the physical properties of minerals, we can use the following: —

(*a*) The density series, showing the range of minerals in specific gravity. This series consists of twenty-seven minerals, including gold, which is twenty-one times heavier than water, and petroleum, which is lighter than that standard liquid. This gradation is made apparent to the eye by means of glass tubes containing equal weights of each of the substances, reduced in the case of solids to a fine powder. Thus gold, with specific gravity 19.5, the heaviest substance, has necessarily the shortest, and petroleum, with specific gravity .75, the longest, tube; and the intermediate tubes show the gradations between these. Thus a series is formed which exhibits clearly that the volume of minerals is inversely proportional to their specific gravity or weight.

There are a number of series showing the relations of minerals to light, among which we may select, by way of illustration, that of the color test, or streak, of minerals.

(*b*) Streak series: lustre metallic, and color mainly essential. This label stands at the head of nine specimens, each mounted upon the same block, with a piece of novaculite of uniform size, such as is used to try the streak of minerals, partly covered with a band of the powdered mineral.

(*c*) Streak series: lustre non-metallic, and color non-essential except when white. This label is at the head of a precisely similar series, but consisting of eighteen minerals with their accompanying stones, exhibiting the great contrast between the color of minerals themselves and of their streaks upon the white surfaces of the novaculite.

(*d*) There are also series of specimens showing the principal minerals which exhibit electrical properties either in their natural conditions, or only when acted upon by friction or heat.

(*e*) Even the taste, touch, and odor of minerals are illustrated by similar series. Though persons cannot imagine how a rare mineral tastes, feels, or smells simply from the sight of it, they all know some of the commoner minerals of the same series which are placed on exhibition. With the guidance of the collection, they can also more easily duplicate the specimens, and understand their relations.

II. In the synoptical collection, the more important and abundant elements are here repeated, and each shelf is devoted to one of the grand divisions of the mineral compounds. Each division of minerals is represented by its most characteristic species; and the subdivisions of the anhydrous and hydrous groups are indicated on the labels, wherever these occur.

III. The systematic collection begins with the native elements, which occupy one wall-case next to the synoptical collection. This is followed by the compounds. These fill the wall-cases on the remaining sides of the room; and here are exhibited the different species of minerals arranged in their proper order as classified by Professor Dana, with some slight changes in the succession of the larger divisions.

Models of the principal or most characteristic crys-

talline forms of each important species have been made out of plaster, and the surface hardened with paraffine in order to give a smooth finish. These are mounted in the same manner as the substances whose structure they are used to illustrate.

It was rightfully imagined, when the present general plan of arrangement for the museum was adopted, that the greatest obstacle in the path of any attempt to show that there was a gradation in the natural relations of the products of the earth would be the department of mineralogy. It has been found, however, that the separation of minerals from the mother-rocks, on account of their purer composition and definite forms, although purely artificial, has its logical uses. It enables one to explain with directness and precision the relations of all the elements and their strictly inorganic compounds, and to prepare the mind for the consideration of the more complicated aspects of the geological and biological collections. Mineralogy is therefore made the vehicle for the conveyance of almost all the preparatory facts in physics and chemistry which are essential for the purpose of the museum.

While such definite marks of gradation cannot be found in minerals as among animals and plants, there is in nearly every division of minerals, even with their present entirely artificial and probably unnatural classification, such distinctions as those of anhydrous and hydrous groups, the simple and double sulphides, the binary and ternary compounds. These have not yet been brought into correlation with the molecular structure, or with each other, in any natural classification; and therefore we cannot say that the hydrous compounds are necessarily, on account of the addition of water to their chemical composition, more complicated in their molecular structure than the anhydrous, or that the same is true of the double as compared with the simple sulphides, or yet of the ternary as compared with the binary compounds.

Notwithstanding these difficulties, the facts are in every case facts of gradation. It makes no difference whether the gradation leads up or down, or mingles both of these tendencies. Whatever direction the true classification may eventually take is immaterial. The indications of what is already known show that gradation of some sort must be its marked characteristic; and this alone is sufficient to harmonize the whole provisionally with the other departments of the museum.

Important support, however, is derived from an opinion in which all chemists and mineralogists consulted seem disposed to agree. There are decided grounds for the belief that both the chemical and the molecular constitution of the elements may be considered as less complicated than that of the purely inorganic and probably derivative compounds, and these, in turn, simpler than the hydro-carbons. Theoretically, also, one is safe in assuming that the latter, which are the products of organic bodies composed of their fossil remains, oils, gums, etc., more or less altered by the physical and chemical conditions to which they have been subjected, are of later derivation in time than the strictly inorganic compounds, and that these, in turn, are probably more recent, as a rule, than the elements of which they are made up.

These fundamental facts are quite sufficient for the purposes of the collection, and permit a demonstration of the fact that the same principles of classification apply in this department as in all others, whether inorganic or organic.

The curator is already in receipt of letters from eminent teachers and others, expressing their gratification at the results of the work in this department, and some of them strongly urge the immediate publication of a proper catalogue.

Harvard university, Cambridge, Mass.

The Jefferson physical laboratory. — The plans of the new physical laboratory, presented to the university by Mr. T. Jefferson Coolidge, have now been so far discussed that we may give a general account of them. The building will be placed about in the centre of Holmes Field, in the rear of the Scientific school, to avoid as much as possible all jars from passing vehicles. The nearest street (Oxford Street) will be about 300 feet from the east wing.

The building consists of an eastern and a western section, each 60×60, connected by a central piece 80×40 ft. The eastern section will contain a large lecture-room, with a seating-capacity of between 275 and 300 students; above this, an immense laboratory, 60×60 ft., for the general use of undergraduates and less advanced students. The basement of this section will be occupied by a workshop, a battery-room, boilers, and coal-bins. The north side of the east section, flanking the lecture-room, is occupied by three stories of rooms for the physical cabinet. These also extend on the north side of the central piece, and are so arranged as to lead conveniently into the lecture-room, the general laboratory, the recitation-rooms, and also into the western section, where the rooms for special investigations are located.

In the central piece, besides the space occupied by the cabinet, there are two recitation-rooms, a balance-room on the first floor, and, on the third floor, rooms for electric measurements, photometry, and a general library and balance room. Small entries and stairways at the east and west end of the centre piece give easy access to all parts of the building for the professors and special students. The undergraduates have access to the lecture-room and general laboratory at the east end of the building by a stairway removed as far as practicable from the rooms devoted to special investigations. This arrangement, and the position of the engines and dynamos on the outside of the building across a deep insulating ditch, will prevent the jar of the machinery and the tramping of students from interfering with delicate observations.

The basement of the central piece is occupied by receiving-rooms, and storage for heavy pieces of apparatus.

The western section is the one which the professors and instructors of physics have most carefully considered. The lower floor contains rooms of moderate size, devoted to general use and special investigations, — rooms which will be fitted up with reference to electricity, heat, magnetism, and sound. In each room of the first floor there are independent piers, built up from the basement, insulated from the walls and floors upon which delicate instruments are to be placed. Similar rooms devoted to optics, electricity, and the Rumford laboratory, are located upon the second story. The third floor is as yet assigned to no definite use, and, with the exception of a room for photography, can be left to meet the wants of the future. The basement of this section is occupied by a room for magnetism, one for heat, and one for weights and measures. A room for constant temperature is excavated below the basement floor in the centre of the building.

To afford facilities for the study of atmospheric physics and experiments for which great height is

needed, a tower runs through the central part of the western section. The tower has a total height of 60 feet; it is built with double walls to isolate it from the rest of the building, the outer walls carrying the floors.

Above the roof, the sides of the tower are almost entirely of glass. There is free access to the four sides of the tower, as well as to the top, which is at a height of 72 feet from the basement-floor. Openings are left at every story to allow light to be sent to the central part of the tower. The piers of the first floor are also so arranged as to obtain lines of considerable length across the building. The doors are so placed that adjoining rooms are readily thrown open together.

The laboratory, built to commemorate Ellen Wayles Coolidge, grand-daughter of Thomas Jefferson, has been named the 'Jefferson laboratory.' It seems most appropriate that the name of one who was among the first to recognize the value of university education in this country should be connected with a building to be devoted to the investigation of some of the most interesting problems of nature.

The cost of the building, with the necessary fixtures, will be about $115,000. There is a fund of $75,000, the income of which is to be expended for the benefit of the physical laboratory, in addition to the appropriations and expenditures now incurred for physics by the college.

NOTES AND NEWS.

Zoölogists the world over will regret to learn of the death of the genial and talented Wilhelm Karl Hartwig Peters, director of the zoölogical museum of Berlin, and younger brother of Dr. Peters of our own Clinton observatory. Dr. Peters was born at Coldenbüttel, near Eiderstedt, in Schleswig, on April 22, 1815, and died in Berlin on the 20th of last month. Immediately after completing his studies in medicine and natural history at Copenhagen and Berlin, he undertook a journey to southern France and Italy to investigate the fauna of the Mediterranean. Returning to Berlin in 1840 as assistant in the anatomical institute of the university, he soon laid his plans for an independent investigation of the unexplored regions of Mozambique, in which he received the advice and support of his distinguished friends, Johannes Müller, Humboldt, Ritter, Ehrenberg, and Lichtenstein, and the powerful patronage of the king, Frederic William IV. He left for this journey — the great event of his life — in 1842, and was absent more than five years. Two years were spent in the interior of Mozambique; but he also made journeys to the Comoro Islands, to Zanzibar, Madagascar, and the Cape, and, before his return, visited the coast of India. His *Reise nach Mozambique*, published between 1852 and 1868 in five quarto volumes, is the result of this exploration, and is a model for faunal work of this kind. Returning to Berlin in 1848, he was made prosector at the institute, afterwards professor extraordinary, and in 1857 succeeded Lichtenstein as full professor in the university, and director of the zoölogical museum. The museum, under his administration, early took the highest rank, which it has ever since held; and more than one American student has been cordially received within its walls. Peters's studies were mainly given to the world in Müller's Archiv, and the publications of the Berlin academy, to which he was elected in 1851. They covered nearly the entire field of zoölogy, but were specially devoted to mammals, reptiles, amphibians, and fish. His geographical discoveries in Mozambique were published by Kiepert in 1849 in a map; and Bleek's *Languages of Mozambique* contains a portion of his linguistic studies.

— The April number of the Harvard university bulletin, which has just appeared, contains fifty-six pages, of which thirty-one are devoted to the book-list. We notice recorded a copy (one of thirty) of the Maya manuscript in the Dresden library, reproduced in polychromatic photography. The appendices contain another instalment of Mr. Bliss's classified index to the maps in Petermann's Geographische mittheilungen (twelve pages), and of Mr. Winsor's valuable bibliography of Ptolemy's geography (seven pages). The University notes mention additions to the zoölogical museum, the purpose of the observatory to collect astronomical photographs, and give an account, reprinted on p. 437, of the plans of the new Jefferson physical laboratory. Among the appointments gazetted, we notice that of Mr. J. Rayner Edmands and Mr. John Ritchie, jun., to the observatory, to be in charge of the time-service and the distribution of astronomical information respectively.

— A general veterinary establishment for the treatment and care of lame, sick, or wounded horses, cattle, sheep, and dogs, is to be maintained in connection with the school of veterinary medicine, of Harvard university. The hospital will probably be ready for occupation June 15. The patients will be under the professional charge of Mr. Charles P. Lyman, fellow of the Royal college of veterinary surgeons, London, and professor of veterinary medicine in the university. The school will also have at its disposal commodious buildings and pastures at the Bussey farm, where cattle can be received and cared for, and where horses not required for present use, or suffering from lamenesses or illnesses which require long seasons of rest, can receive all proper care and treatment, together with the benefit of grass-paddocks in summer, and a warm straw-yard in [illegible]nter. Any person having sick or lame animals to be cared for can procure for them the benefits of the establishment upon the payment of a fixed sum per day, covering board, treatment, and medicines. To each subscriber of ten dollars a year, a number of privileges will be given. On Tuesdays and F[illegible]days a free clinic will be held.

— The semi-annual meeting o[illegible] the American antiquarian society was held in Boston on April 25 at eleven o'clock. About fifty members were present. The reports of the officers showed that the affairs of

the society were in good condition, although the council felt the need of a special fund for the salary of a person to fill the place of the late Dr. S. F. Haven. Mr. Samuel S. Green of Worcester read a paper of local interest in relation to the First parish of that city; Mr. Andrew M. F. Davis of San Francisco discussed the question of bearded men reported to have been seen by Moncatch-Apé on the Pacific coast of America before 1758; Mr. F. W. Putnam of Cambridge gave an account of the use of native metals by the mound-builders of the Ohio valley, and exhibited ornaments from the mounds made by hammering native copper, silver, gold, and meteoric iron; Mr. Putnam also read a paper on Iron in the Ohio mounds, a critical review of the misconceptions of two writers of sixty years ago; and Mr. H. W. Haynes of Boston presented by title a paper on Ancient soapstone-quarries. Two of these papers are noticed more fully in our Weekly summary. After adjournment the members were invited to lunch at the residence of Mr. James F. Hunnewell in Charlestown, after which a visit was made to Bunker Hill by invitation of the directors of the Monument association.

— Mr. F. W. Putnam lectured on Recent discoveries in American archeology before the Harvard historical society, Cambridge, May 7, illustrating his discourse with stereopticon views.

— The effort to raise money to pay off the debt of the Academy of sciences of Davenport, Iowa, has met with good success. Not only has enough been obtained for that purpose, but a start has been made with an endowment fund to place the institution on a firmer basis. The feeling of interest in the academy, which was created among the business-men at a meeting held April 24, continues to spread. There seems to be little doubt that the continued usefulness of the institution is assured.

— At the meeting of the American academy of arts and sciences, April 11, the papers read were by Professor William A. Rogers, Results of the comparisons of three independent copies of the imperial yard, and of four independent copies of the metre of the archives; Dr. Otto Struve, Aberration; Mr. S. C. Chandler, On the variable star, R. Aquarii; and by Prof. E. C. Pickering, on the measurements made of the photographs of stellar spectra obtained by the late Dr. Henry Draper.

— At a meeting of the section of mechanics and engineering of the Ohio mechanics' institute, held April 24, Mr. Alfred R. Payne read a paper on Utilization of sewage from the hills, discussing the value of both the fertilizing material and the water-power.

At the meeting of the section of chemistry and physics, April 26, papers were read by Prof. F. W. Clarke, on Tartrates of antimony; by Prof. H. T. Eddy, on the Kinetic theory of solids, fluids, and gases; and by Professor Robert B. Warder, on a Proposed systematic computation of data relating to the speed of chemical reactions. The section resolved to undertake the computation (on some fixed system of units), with such co-operation as other chemists and physicists may kindly afford.

— The summer course of instruction in botany in Harvard university will begin on July 6, and continue six weeks. The principal part of the instruction will be given by Professor William Trelease of the University of Wisconsin, but lectures will be given also by Professor Goodale.

— At the meeting of the Biological society of Washington, April 27, the following communications were made: Prof. C. V. Riley, Another jumping-seed, Remarks on bee-fly larvae and their singular habits, A burrowing butterfly larva; Mr. H. H. Birney, Remarks on Samia cynthia, the Ailantus moth; Professor Theodore Gill, The Stromateidae; Dr. Frank Baker, The origin of dextral preference in man. A field meeting of the society took place on Saturday, April 28, at Bladensburg.

— At the meeting of the Society of arts of the Massachusetts institute of technology, April 26, Mr. A. E. Burton spoke on the Topographical methods of the U. S. coast-survey, and Mr. W. H. Pickering on the Sensitiveness of photographic plates.

— On the 31st of March, the Weymouth and Channel Islands steam-packet company's steamer Aquila, on her way across the channel, was suddenly struck by mountainous seas, which sent her on her beam-ends, and washed the decks from stem to stern. As the decks became clear of water, the bulwarks were found to be broken in several places, one of the paddle-boxes was considerably damaged, the iron rail on the bridge was badly twisted, the pump was broken, the skylights broken, and the cabins flooded. Five minutes after the waves had struck the steamer, she came again into smooth water.

— In 1882 there were built and registered in the United Kingdom, as British ships, 453 iron steamers having a gross tonnage of 676,338, and 64 steel steamers having a gross tonnage of 113,389. The percentage of steel gross tonnage is 14, while for 1881 it was but 11. There were 91 iron and steel sailing-ships built and registered during the same time, having a gross tonnage of 126,398.

— The second number of *Appalachia*, vol. iii., has recently appeared. Prof. E. C. Pickering discusses the value of mountain observations for astronomical work, and suggests the use in them of the horizontal telescope, lately devised by him, before which the observer may sit in a comfortable position and in a warm room. Mr. Scott, vice-president of the club, describes a trip to the Twin-Mountain range; and Mr. J. W. Chickering, a longer excursion to Roan Mountain, in North Carolina. Mr. E. G. Chamberlain maps the Blue Hills near Boston, and gives a list of distant points seen from their summit.

Mr. W. O. Crosby presents the results of his studies on the mountain-reefs of eastern Cuba, of which an abstract will be printed in our geographic columns. Mr. J. Tatlock, jun., discusses the variation of barometric measurements with the season. Various reports and proceedings fill about half of the hundred pages. The club's growth in popularity, as shown by its rapidly increasing membership of both sexes, has by no means diminished the scientific value of its publications.

— The general catalogue of the American exhibit at the London fisheries exhibition, referred to on a previous page, and which is now in course of publication, will be followed by a series of special catalogues of the more important sections, which will contain much fresh information regarding the distribution, abundance, and relationships of the species exhibited. The handbooks of two sections — that of the birds, by Mr. Ridgway; and that of the invertebrates, by Mr. Rathbun — are now in press.

— It may not be generally known that Harvard college observatory took an important part in the early experiments made in astronomical photography. Under the direction of Prof. W. C. Bond, the first daguerrotype of a fixed star, and many early representations of other objects, were obtained there. After the invention of the collodion process, Prof. G. P. Bond returned to the subject, and obtained an interesting series of photographs of various celestial objects. While stars of the first magnitude only could be depicted by the daguerrotype, the new process rendered it possible to photograph stars of the fourth. Professor Bond paid special attention to the means afforded by photography for the accurate measurement of double stars. For this purpose he procured numerous photographs of the star Mizar (*ζ Ursae Majoris*), which he afterwards measured micrometrically. The accuracy of the results was remarkable; and the average discordance of the values obtained from the photographs taken on eight different evenings was only 0.3″.

— The second part of vol. iii. of Anales of the Mexican national museum is devoted to the following papers: 1. Continuation of the study upon the *Piedra del sol*, by Alfredo Chavero; Glossary of Castilian words derived from the Mexican, or Nahuatl, by Jesus Sanchez; Mexican antiquities, by Cárlos Fernandez. In the list of Sr. Sanchez are more than two hundred words derived from the aboriginal Mexican, a few of which are already in the vocabulary of the United States; and some of them have become reputable English words, such as, cacao (*cacahuatl*), cocoa (*cocoa*), copal (*copalli*), coyote (*coyotl*), Chile (*Chilli*), chocolate (*pozolatl?*), mezcal (*mexcalli*), mezquite (*mizquitl*), ocelote (*ocelotl*), pinole (*pinolli*), tomato (*tomatl*), tule (*tollin*).

— Professor Aeby has published a diagram of the course of the nerve-fibres in the human central nervous system, which is very warmly praised, and recommended to students and teachers alike. The publisher is Dalp in Bern; the price, 1 mark and 60 pfennigs.

RECENT BOOKS AND PAMPHLETS.

Allieri, L. Equilibrio interno delle pile metalliche secondo le leggi della deformazione elastica. Roma, *Loescher*, 1882. 119 p., 7 tables. 4°.

Beilstein, F. Handbuch der organischen chemie. Leipzig, *Voss*, 1883. 2185 p. 8°.

Binzer, J. M. v. Vacuosität und schwerkraft. Nachweis der gemeinsamen ursache der attractions- und gravitations-phänomene einschliesslich der magnetismus auf grund physikalischen thatsachen. Salzburg, *Dieter*, 1883. 49 p. 8°.

Bottler, Max. Exkursions flora von Unterfranken. Ein taschenbuch zum leichten bestimmen der in Unterfranken, auf dem Steigerwalde und in der Rhön wildwachs. Phanerogamen. Kissingen, *Hailmann*, 1883. 6+208 p. 8°.

Bowman, W. H. Lecture introducing his system of respiration for the development and treatment of the vital organs of the body. Boston, *Mudge, pr.*, 1883. 30 p. 8°.

Brunbauer, Paul. Der einfluss der temperatur auf das leben der tagfalter. Inaug. diss. München, 1883. 115 p. 8°.

Compte rendu des travaux du service du Phylloxera. Année 1882. Procès-verbaux de la session annuelle de la Commission supérieure du Phylloxera. Rapports et pièces annexes. Lois, décrets et arrêtés relatifs au Phylloxera. Paris, *Impr. nat.*, 1883. 603 p. 8°.

Congrès géologique international. Compte rendu de la 2d session, Bologne, 1881. Bologne, *impr. Fara et Garagnani*, 1882. 15+661 p., 19 pl. 8°.

Falb, Rud. Meteorologische betrachtungen mit besondere bezugnahme auf die periodischen ueberschwemmungen. Wien, *Hartleben*, 1882. 6+152 p. 8°.

Gilardini, G. Principio della scienza idraulica italiana. Milan, *tip. Osserv. cattolico*, 1882. 23 p. 16°.

International (Great) fisheries exhibition. London, 1883. United States of America. A. Preliminary catalogue and synopsis of the collections exhibited by the United States fish commission and by special exhibiters; with a concordance to the official classification of the exhibition. Washington, *Government*, 1883. 106 p. 8°.

Kempe, H. R. Handbuch der elektrizitätsmessungen. Aus dem englisch übertr. v. J. Baumann. Braunschweig, *Vieweg*, 1883. 8+308 p. 8°.

Konkoly, Nic. v. Praktische anleitung zur anstellung astronomischer beobachtungen mit besonderer rucksicht auf die astrophysik. Braunschweig, *Vieweg*, 1883. 22+912 p., 345 cuts. 8°.

Lassalle, C. Origin of the western nations and languages: showing the construction and aim of Punic recovery of the universal language, reconstruction of Phoenician geography, Asiatic source of the dialects of Britain, principal emigrations from Asia, and description of Scythian society. With an appendix upon the connection of Assyrian with the language of western Europe, and Gaelic with the language of Scythia. London, *Heywood*, 1883. 420 p. 8°.

Maine, Sir H. S. Dissertations on early law and custom, chiefly collected from lectures delivered at Oxford. London, *Murray*, 1883. 402 p. 8°.

Moncel, Th. du, et **Geraldy**, F. L'Électricité comme force motrice. Paris, *Hachette*, 1883. 308 p., 112 fig. 18°.

Nebst, E. Moderne instrumentenkunde. Braunschweig, *Vieweg*, 1883. 22+912 p., 345 cuts. 8°.

New York — Department of public parks. Report of the New York meteorological observatory for the year 1882. N.Y., *City*, 1883. (13 p.) 4°.

North Carolina — Board of agriculture. Annual report of the agricultural experiment station for 1882. Raleigh, *Ashe & Gatling*, 1883. 8+150 p. 8°.

Rodriguez Mourelo, J. La radiafonía, estudio de una nueva propiedad de las radiaciones. Madrid, *impr. Hernández*, 1883. 15+286 p., pl. 8°.

Romanes, G. J. Scientific evidences of organic evolution. N.Y., *Macmillan*, 1883. (Nature series.) 6+88 p. 12°.

Taber, C. A. M. How the great prevailing winds and ocean currents are produced, and how they affect the temperature and dimensity of lands and seas. Boston, *Williams*, 1882. 82 p. 12°.

Thurston, R. H. Conversion tables of metric and British or United States weights and measures. N.Y., *Wiley*, 1883. 12+83 p. 8°.

☞ **A TRIBUTE TO AN EMINENT MATHEMATICIAN AND ASTRONOMER.**

BENJAMIN PEIRCE, LL.D.

FOR FIFTY YEARS MATHEMATICIAN AT HARVARD UNIVERSITY.

A MEMORIAL VOLUME, BY MOSES KING.

Small quarto. Exquisitely printed. 64 pages. Cloth covers, $1.00; paper covers, 50 cents. With portrait finely engraved on wood.

THIS little volume, which was published immediately after the death of Professor Peirce, has met with a constant sale, although it was designed merely as a token of gratitude. Its contents include an interesting biography by ex-President Thomas Hill, LL.D.; an address by James Freeman Clarke, D.D.; a eulogy by the Rev. Dr. A. P. Peabody; a sermon by the Rev. Dr. Thomas Hill; and a sermon by the Rev. Dr. Cyrus A. Bartol. It also contains a sonnet by Thomas William Parsons; a poem by Oliver Wendell Holmes; the resolutions passed by Harvard University, the American Social Science Association, etc.: and reprints from many of the foremost dailies and periodicals. It has an introduction by Moses King, and notes on the professor's last illness, decease, and funeral, by his son, Professor James Mills Peirce. In addition, it has as a frontispiece a finely engraved portrait, and several miscellaneous reprints of prose and poetry. The volume is exquisitely printed, and tastefully bound.

PROFESSOR BENJAMIN PEIRCE, LL.D.

The little volume has received the warmest commendation of the friends of Benjamin Peirce, and of Harvard University, and of science the world over. It will be remembered that Professor Peirce, for nearly half a century served the University as one of its most faithful officers, and for fully two generations did as much as any one of his colleagues to add lustre to that institution with which he was so long identified, and was always regarded as one of America's foremost scientific men.

Although this volume is merely a convenient reference-book for the future biographer, it seems to serve its purpose as a temporary biography. Among its testimonials are the following:—

"I thank you heartily for the memoir of my dear friend Professor Peirce." — JAMES FREEMAN CLARKE.

"It is prepared, it seems to me, with admirable taste and skill, and must be highly valued by all who knew him."— Professor EZRA ABBOT.

"Your excellent memorial collection . . . is of much interest as a record of the sentiment of the community upon Mr. Peirce's death." — Professor CHARLES E. NORTON.

"The compiling of it was a most happy thought, well executed." — Professor ALBERT C. PERKINS.

"The tributes are very noble, several of them, and you have deserved well of his friends, of Harvard, and of humanity, in collecting them."— Professor JAMES K. HOSMER.

"The attractive volume will be welcomed by the many students and friends of the deceased."— *Zion's Herald.*

"The volume is a fitting memorial of its great subject." — *Yale Courant.*

"An admirable little memorial." — *Editor Springfield Republican.*

"It is in the neat style in which Mr. King does all his work."— *Woman's Journal.*

A copy will be sent, postpaid, to any address, on receipt of the price, — one dollar for cloth binding, and fifty cents for paper covers. The compiler and publisher is Moses King, the publisher of "Science," Cambridge, Mass.

STUDENTS' SONGS.

A new collection of songs, as sung by jolly students at all leading colleges throughout this country, has just been published, under the title of "STUDENTS' SONGS," by Moses King, Cambridge, Mass. It contains 64 pages of songs, with full piano accompaniments, and sells at only 50 cents a copy.

A WORLD-WIDE SUCCESS.

"SCIENCE," although only three months old, has met with the most remarkable success ever attained by an American periodical which has aimed at its high standard of contents. Already it has subscriptions in every State in the Union, in several of the Territories, in every province of British America, in many of the countries of South America, in England, Ireland, and Scotland, in Austria, Germany, France, Switzerland, Russia, New Zealand, and Australia. It is true, we have but a small number of subscriptions, as yet, in these foreign countries; but it is a far larger number than we had hoped to have, until after "Science" had been published for as many months as it has been for weeks. It may seem unpardonable boasting; but as the success of "Science" means, not a success of its publisher, but the favorable reception of the combined work of the leading scientific men of America, it is merely an acknowledgment to them, that the publisher here records the success with which the journal is meeting.

DOES ANY ONE HARBOR A DOUBT?

If any one is sceptical as to the value of advertising, or the interest taken by the public in "Science," let him consider this fact,—that a recent advertisement in "The Nation," published in New York, brought in *four hundred* replies, including subscriptions, and requests for specimen copies. It may also be stated, that, in a late issue of "Science," two lots of second-hand books were advertised for sale. Both of the advertisers sold their books, and are well pleased with their investment. The close observer will notice that some of our advertisers are constant patrons, and it is owing to the fact that their advertising in "Science" has been found remunerative. Such firms are the Forbes Lithographing and Engraving Co. of Boston; the Electrical Supply Co. of 17 Dey St., New York; Mr. Charles Williams of 109 Court St., Boston; Mr. John C. Paige, the American representative of the City of London Fire Insurance Co. of England; the Rumford Chemical Works, preparers of the Horsford Acid Phosphate; and others, whose advertisements will in time become quite familiar to readers of "Science." People who have something to sell, and those who want something, will do well to consider the advantage of "Science" as an advertising medium; for, with its from six thousand to ten thousand copies a week, it reaches an intelligent class of people throughout the civilized world. A schedule of advertising rates will be sent, on request, to Moses King, publisher, Harvard Square, Cambridge, Mass.

UNIQUE ADVERTISING.

In a short time there will be introduced into "Science" several unique pages of advertising. The reason for doing this is to get our readers into the habit of looking through all the pages of the journal, for we want to get into the successive issues of "Science" the various announcements of leading manufacturers and dealers throughout the world; because (1) it is a money help to the journal, and (2) it is an advantage to the reader of the journal to know where and with whom he can open correspondence in regard to business matters, with the utmost confidence that he is dealing with thoroughly trustworthy firms. Business-men like to advertise, but they can afford to advertise only when they feel sure that their advertisements are read and responded to. Therefore we shall try to make our advertising pages attract attention, and then hope that they will be looked through by our readers, and responded to whenever they seem to make a tempting appeal. In cases of response be kind enough to mention "Science."

SCARCITY OF PAPERS.

No. 1 of "Science" has already become scarce, and the publisher can now furnish it only to those who subscribe to the journal for one full year (at $5) from the beginning. The supply of copies of No. 2 is also running short; and it is hoped that subscribers to "Science" will take care to keep complete the files of the journal, for it will not be long before the first volume will command a premium on its cost.

HARVARD UNIVERSITY.

There has just appeared a new edition of the only guide-book made to Harvard University. It is called "Harvard and its Surroundings," and is a handsome volume of a hundred and eight pages. It is illustrated with photo-engravings, woodcuts, and albertypes. There are about forty albertypes, which are in effect photographs; so that a person owning a copy of this book has in reality a photograph-album of the whole of Harvard University; for every building of all the departments—the College, Law School, Medical School, Museums, Dental School, etc.—is very prettily shown in this book. It is also a satisfactory history and description, for it was compiled with the aid of the chief officers of the University. In paper covers, it is sent to any address, postage prepaid, on receipt of one dollar. In cloth binding, the price is one dollar and fifty cents. The author and publisher is Moses King, Cambridge, Mass.

BINDERS FOR "SCIENCE."

Subscribers wanting binders in which to bind temporarily the successive issues of "Science," as they appear from week to week, can obtain a good binder from Moses King, Cambridge, the publisher of "Science," by sending one dollar. The binder is a simple one, made of proper size, and stamped appropriately. The price stated above includes cost of packing, postage, and shipping to any address in the United States.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence about contents of paper to "Editor of SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

SCIENCE.

AN ILLUSTRATED JOURNAL, PUBLISHED WEEKLY.

OWNED BY THE SCIENCE COMPANY.

OFFICERS AND DIRECTORS.—D. C. GILMAN, of Baltimore, *President;* GARDINER G. HUBBARD, of Washington; ALEX. GRAHAM BELL, of Washington, *Vice-President;* OTHNIEL C. MARSH, of New Haven; SAMUEL H. SCUDDER, of Cambridge, *Treasurer.*

SUBSCRIPTIONS.—In United States and Canada, $5 a year. In Great Britain and Europe, $6 a year.

MOSES KING, *Publisher*, CAMBRIDGE, MASS.

FRIDAY, MAY 25, 1883.

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

In compliance with the requirements of the nineteenth article of the regulations, the international committee of weights and measures has issued its report for the year 1882, and of the present condition in the progress of its important work. It is the most satisfactory report so far made; and it shows every thing to be in such good order, and working so well, that the delivery of the international standards may be expected to be begun during next year. To the present time the progress has necessarily been slow, as the important questions of means and methods had to be carefully considered before adoption. Now, however, we see the methods settled, the means at hand, and the contracts let for the delivery of the bars for the international metres, and the ingots for the kilograms.

The report covers the operation of the calendar year 1882. During the year important advances were made in the instrumental outfit. The universal comparator, which was ordered in 1877, and was for four years in process of construction by Starke & Kammerer in Vienna, was received at Breteuil in November, and is now undergoing a thorough examination and testing of all its parts, previous to its use in determining the values of the new line metres.

A contract has been entered into, between the bureau and the *Société génevoise pour la construction d'instruments de physique et de mécanique*, for the delivery, by the latter, of a comparator for testing base bars, whether of line or end measure, of lengths up to and including four metres; the outfit of the comparator to include two four-metre line-standards, each subdivided into single metres by lines drawn on platinum-iridium plugs inserted at proper intervals. These standards are to be of wrought iron, T-shaped in cross-section. In addition to the subdivision into metres, one of these standards is to have two additional lines 0.051 metre within the four-metre lines (the space so marked serving as a double-toise standard), and two lines 0.060 metre without the four-metre lines (this space serving as the standard for comparison of four-metre end-measures by the use of contact cylinders). The contract price for this apparatus, delivered and mounted, is 34,000 francs. It is to be delivered at Breteuil before the end of July of this year.

The balance for vacuum weighings was received, but certain defects in its construction required it to be returned to the maker for alteration. Unhappily the condition of his health has delayed the necessary work; and, as it did not seem probable that he would be able soon to give the matter his personal attention, the execution of the details of alteration has been intrusted to other hands, and it is expected that the balance will be in satisfactory working-order before the end of the present year. Under the care of M. Marek, the other balances have been placed in position; and every thing is in readiness for the weighings in air and for the hydrostatic weighings.

The Fizeau expansion apparatus has been so modified as to admit of experiments in vacuum, and the tests of the modified apparatus have been most satisfactory. From the observations for the expansion of the platinum-iridium tripod of the apparatus, data were obtained for ascertaining, more surely than ever heretofore, the index of refraction of air between 0° and 80° C.

The air-thermometer apparatus has been perfected; and it is hoped that the comparisons of thermometers, retarded by the illness of Dr. Pernet, will soon begin.

The contract for furnishing the bars for the metres, and the ingots for the kilograms, has been given to Messrs. Johnson, Matthey, & Co., of London. This house agrees to furnish thirty bars, X-shaped, and further specified as follows: the length to be 1.20 metres; the density, not less than 21.5; the alloy to be such, that, in 100 parts, there shall be not less than 89.75 nor more than 90.25 parts of platinum, and not less than 9.75 nor more than 10.25 of iridium, with a tolerance of 0.1 iron, 0.1 ruthenium, 0.15 rhodium and palladium,

and 0.02 gold and silver. The bars are to be of homogeneous metal, entirely soluble in *aqua regia*, and of uniform density. This density is to be ascertained from two specimens taken from the two ends of the bar. Before making the alloy, there shall be taken, from a mass of at least 20 kilograms, two specimens of each metal; and the same shall be done with the alloy before proceeding to make the bars or kilograms. These specimens will then be sent to a member of the international committee at Brussels, and to a member of the French section at Paris, respectively, for independent analysis; and the work shall not proceed until these specimens are examined and approved. The bars shall present no defects which will not disappear in the finishing; and this finishing shall not be undertaken until the rough bars have been submitted, examined, and accepted, provisionally, by the French section. Messrs. Johnson, Matthey, & Co., are left free to use their own judgment as to the best method of preparing the pure metal, of making the alloy, and of making the bars. If any bars are rejected, they shall be returned to the makers; and the French government shall not be held liable either for the labor expended or for the value of the metal.

Messrs. Johnson, Matthey, & Co., further agree to furnish forty ingots of the same metal for the construction of the international kilograms. Each piece is to weigh between 1.150 and 1.200 kilograms, and to be subject to the same conditions, regarding composition, alloy, and density, as the bars.

For this work the makers are to receive 2,000 francs per kilogram for the alloy accepted, 2,500 francs for work on each bar, and 150 francs for work on each kilogram. In part-payment, they are to take all unused alloy at the rate of 900 francs per kilogram, and the sample specimens sent to Brussels and Paris at the rate of 2,000 francs per kilogram.

Before undertaking the adjustment of the international standards, it was necessary to prepare authentic copies of the original prototypes. This delicate work was intrusted to two joint committees, composed of members of the international committee and of the French section, one having charge of the comparisons of length, and the other of those of weight. The comparisons were successfully made. The copies of the *mètre des archives* and of the *kilogramme des archives* are of platinum-iridium, fulfilling all the conditions above mentioned, as required for the new international standards.

On the 26th of April, 1882, there was held a meeting, at which were present the minister of commerce, the director of the international bureau, and five members of the international committee and French section. After a statement of the comparisons made, and results obtained, the type-metre and type-kilogram were, in the presence of the above-mentioned parties, formally delivered into the hands of M. Broch, the director of the international bureau, who, from that moment, was charged with the care, custody, and preservation, of these important articles. These types will serve as the standards for the international metres and kilograms; and the limit of error allowable in the marking and adjustment of the latter is fixed at ± 3 microns for the metre, and ± 0.2 milligram for the kilogram.

To hasten as much as possible the final adjustment of the international standards, it is ordered that the French section transmit each metre and kilogram as it is ready, without waiting for the preparation of the entire number. In this way the comparison and verification will be in execution by the international committee, while the tracing of the metres, and adjustment of the kilograms, are being done by the French section.

The construction and verification of the thermometers which are to accompany the standards will be the care of the international committee.

During 1882 the *personnel* of the international committee remained unchanged. The committee will, however, soon suffer a loss in the departure of one of its most able members, M. Marek, who leaves to accept a position in the Austrian bureau of weights and measures. The resignation of M. Marek was accepted, to take effect at the close of last year; but at

the urgent request of the committee, and by permission of the Austrian government, he remains a few months to attend to the printing of important papers, which will appear in the next volume of the *Travaux et mémoires* of the bureau, and to superintend the adjustment of the new universal comparator.

In the latter part of 1881 the kingdom of Roumania expressed a desire to subscribe to the regulations of the international commission, and is now numbered among the states represented in that body. The metric system is now used in all official transactions in Roumania; and on the 1st of January, 1884, its use will become compulsory throughout the kingdom.

RECENT EXPLORATIONS IN THE REGION OF THE GULF STREAM OFF THE EASTERN COAST OF THE UNITED STATES BY THE U. S. FISH-COMMISSION.[1]

1. Introductory.

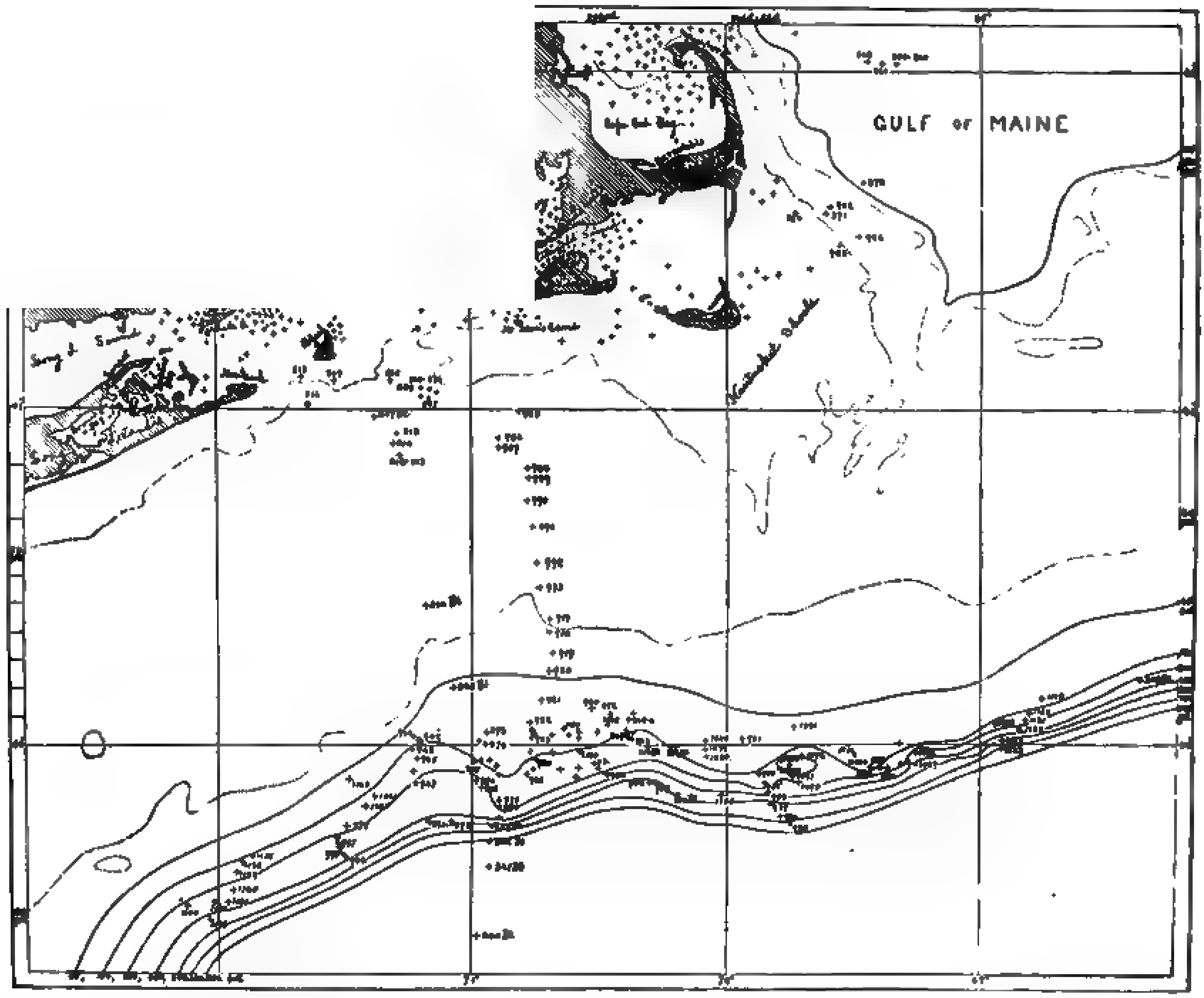
ALTHOUGH several extended surveys along the region of the Gulf Stream had been made by the officers of the U. S. coast-survey since 1844, no systematic dredging had been done along its course, north of Florida, until 1880. During the previous surveys, large numbers of bottom samples had been saved. Some of these were studied many years ago by Professor Bailey, and later by Mr. L. F. de Pourtalès. Many of the Foraminifera and other microscopic forms have been described by them. A few small shells from the same source were described by Dr. A. A. Gould in 1862. These investigations gave a general idea of the nature of the materials of the bottom and the depth, but many errors existed in the earlier surveys in the determinations of temperature, and in many cases the recorded depths were unreliable. The extensive surveys made by the Blake, since 1880, have been conducted with much better apparatus and greater accuracy.

The real character of the fauna inhabiting the bottom beneath the Gulf Stream, off our coast, was completely unknown until 1880, when numerous and successful dredgings were made, first, by Mr. Alexander Agassiz, on the coast-survey steamer Blake (J. R. Bartlett, U.S.N., commanding), and, later in the season, by the U. S. fish-commission party, on the Fish Hawk. The Challenger, on her celebrated voyage, made a line of dredgings from Bermuda toward New York; but, on approaching our coast, she turned northward, and went to Halifax. Her station nearest to our coast was about 160 miles off New York, in 1,240 fathoms. This is much farther off the coast than any of the fish-commission dredgings, and outside the Gulf Stream slope. The few dredgings made by the Challenger off Halifax were partly on the shallow fishing-banks (Le Have bank), and partly in the deep water of the Atlantic basin. By mere chance, therefore, the Challenger missed the discovery of the exceedingly rich and varied deep-water fauna that is now known to occupy the Gulf Stream slope all along our coast. In 1872 one haul was made by Messrs. S. I. Smith and O. Harger, on the Bache, in 430 fathoms, south of George's bank, on this slope; but it happened to be on a comparatively barren spot. In 1877 the U. S. fish-commission party dredged on the northward continuation of the slope, about 120 miles south of Halifax, in 90 and 190 fathoms; but the bottom was of barren gravel, and the results meagre and unsatisfactory. In that region the cold currents are rapid, and the slope of the bottom is exceedingly steep, making the dredging very difficult. In 1880 Mr. A. Agassiz, while on the Blake, made several lines of dredgings off our eastern coast, crossing the Gulf Stream slope. The most southern of these were off the Carolina coasts, and the most northern stations were just south of George's bank. These dredgings extended from shallow water to 1,632 fathoms. The Blake was furnished with excellent apparatus for sounding and dredging, temperature determinations, etc. The officers of the Blake secured by this exploration a large amount of reliable physical data; and Mr. Agassiz obtained very interesting collections, including large numbers of new forms of animal life, many of which have already been described in the bulletin of the Museum of comparative zoölogy.

Later in the season of 1880, the U. S. fish-commission dredging-party, under the direction of the writer, made its first expedition to the Gulf Stream slope in the steamer Fish Hawk (Lieut. Z. L. Tanner commanding). The region visited was about 75 to 80 miles south of Martha's Vineyard, in 65 to 192 fathoms. On Sept. 4, when this ground was first visited by us, a long day was spent in dredging and trawling, and with marvellous results. The bottom was found to be occupied by an exceedingly rich and abundant fauna, including great numbers of new and strange forms of

[1] This article is published by permission of the U. S. fish-commission.

animals belonging to nearly all the marine orders. Many fishes never before taken on our coast were secured. Thousands of beautiful and undescribed star-fishes of many species, with varied shapes and colors, encumbered our deck. Crabs and shrimps of strange kinds, some of them of large size, were taken by thousands. Numerous new and curious species of shells, some of them very beautiful; bushels of large and brilliantly colored sea-anemones, several of them over a foot across, and most of them previously unknown; with sea-pens and corals of elegant forms and colors, — were among the more conspicuous treasures secured on that ever memorable day. So successful were we, that it required the most diligent and devoted labor on the part of our entire party, — though aided by the officers and sailors of the steamer, who shared more or less in our enthusiasm, — from daylight in the morning till late at night, to preserve what we had secured, notwithstanding we threw away many thousands of duplicates. Some idea of the richness of this fauna, and of the abundance of life on the bottom in this region, may be gathered from the fact that it required about five barrels of alcohol to preserve the portion of the catch that we saved on this one day, and a similar amount was used by us on various subsequent trips in a single day. On our first day eight hauls were made, mostly with a large beam-trawl. There was a very heavy swell, due to a violent cyclone that had prevailed farther south a few days before.



MAP I. — Southern coast of New England to the Gulf Stream slope, showing lines of depth and the positions of the principal dredging-stations of the U. S. fish-commission, 1871, 1874, 1875, 1880–82. The crosses (+) indicate dredging-stations, part of which are accompanied by their serial numbers corresponding to the records and published lists. Those bearing numbers between 309 and 347 were occupied by the Blake in 1880.

Under these circumstances, the dredging and the care of the specimens were unusually tiresome: otherwise our enthusiasm would, per-

FIG. 1.—The beam-trawl. The length of the beam, *a*, *a*, varies from 12 to 15 feet in those used by us. The height of the iron runners, *b*, *b*, supporting the beam, varies from 24 to 30 inches; the length of the net, *d*, from 25 to 35 feet or more. The pockets, *e*, within the net, are to prevent the escape of fishes. The drag-rope, *c*, *c*, is weighted with lead sinkers.

haps, not have allowed us to retire, even at midnight. But a touch of genuine seasickness will dampen the ardor even of the most enthusiastic naturalists when hundreds of new and strange species are before them.

This first trip having been so successful, two others were made, later in the season, to other parts of the slope, in depths ranging from 85 to 500 fathoms. Each trip proved equally productive, and added many species to the long list of discoveries.

In 1880 the headquarters of the fish-commission were at Newport, R.I.; but in 1881 and 1882 they were at Wood's Holl, Mass., where a laboratory had already been fitted up in 1875. In 1881 and 1882 the exploration of the Gulf Stream slope was continued, whenever the weather was sufficiently favorable to permit us to make a trip in the Fish Hawk without too much risk.

The steamer Fish Hawk, with which we have explored this region during the past three seasons, was built particularly for use in the hatching of shad-eggs in the mouths of shallow rivers, and was therefore not adapted for service at sea, unless in fine weather. A much larger iron steamer — the Albatross, of 1,000 tons — has recently been built for the use of the fish-commission, and is now being fitted up expressly for deep-sea service, for which she will be in every respect well adapted, and will have the best equipment possible for such investigations at all depths. The examination of the bottom beyond the depth of about 700 fathoms has, therefore, been deferred until the completion of the Albatross.

In addition to the three trips made in 1880, seven trips were made by us in 1881 from Wood's Holl, and in 1882 five trips. During these fifteen trips, on each of which a single entire day was usually employed in dredging, we occupied about 113 stations. At nearly all these stations we used a large beam-trawl of improved construction (fig. 1). In a few

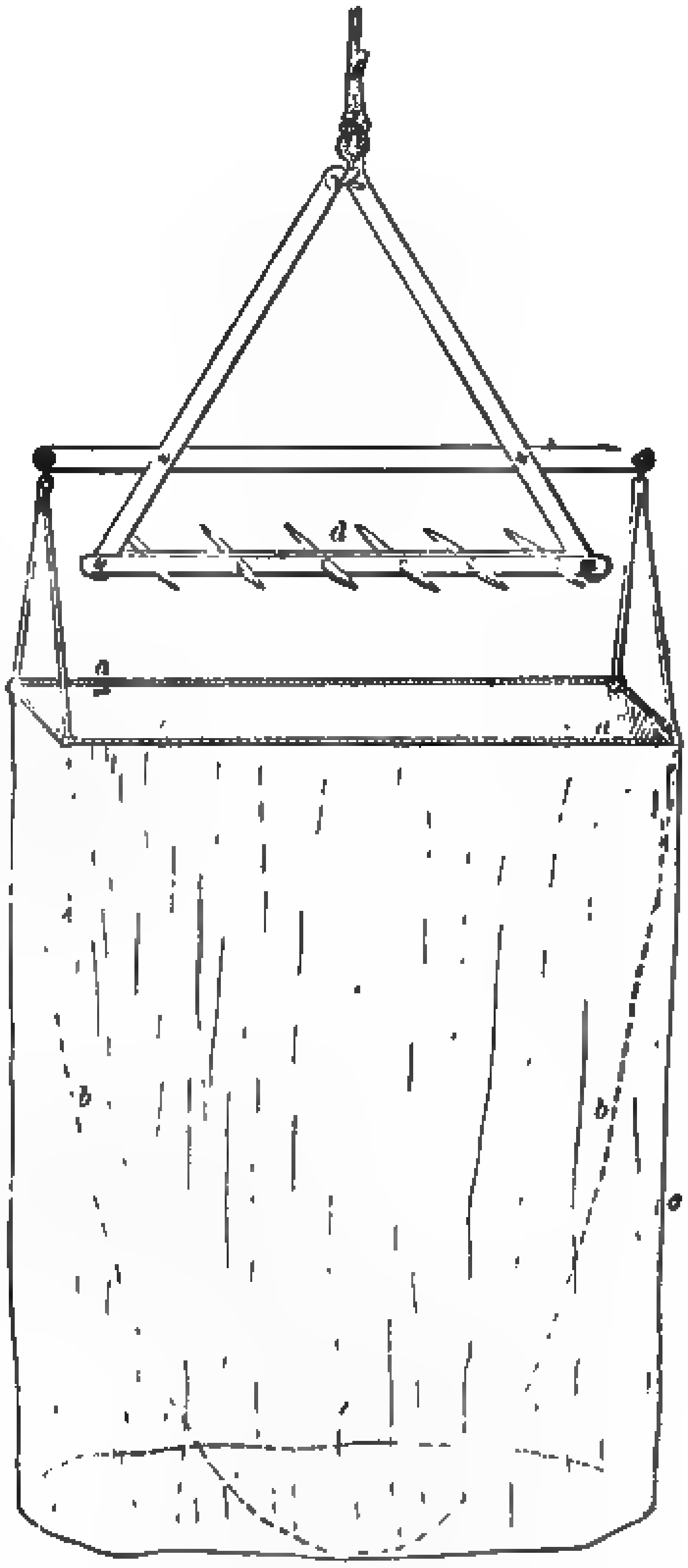


FIG. 2.—The rake-dredge rigged for use. The iron frame carrying the teeth, *d*, is about 3 feet wide; the teeth, about a foot long. The frame, *a*, carrying the net, *b*, is 4 feet long; *c* is a canvas bag to protect the net.

instances we used a large rake-dredge (fig. 2). On every trip fine surface-nets, or towing-

nets (fig. 3), were used to capture free-swimming animals, whenever the motion of the steamer was sufficiently slow to permit

FIG. 3. — The towing-net, in the position that it takes while in use, half buried beneath the surface of the water. Those used by us are mostly 10 to 14 inches in diameter.

this mode of collecting. In these towing-nets, and in long-handled dip-nets, we secured a great variety of pelagic creatures, such as jelly-fishes, Salpa, Sagitta, various small Crustacea, and especially large numbers of Entomostraca.

Our dredgings in this region now cover a belt about 160 miles long, east and west, and about 10 to 25 miles wide. The most eastern stations are south-east of Cape Cod; the most western are south of Long Island. They are mostly between 80 and 110 miles from the coast-line of southern New England (see map, p. 444). The regular work of the party during the season, Capt. Tanner made a special trip to the Gulf Stream slope, off Chesapeake Bay, in 1880, and another off Delaware Bay in 1881. On both of these occasions valuable collections were made, and additional data in regard to the depth and temperature were obtained. He occupied seven stations, in 18 to 300 fathoms, in 1880; and eight stations, in 104 to 435 fathoms, in 1881. These dredgings show the direct southward continuation of the inshore cold belt, and the warm belt outside of it, as well as the cold deep-water belt, with but little change in the fauna of each.

2. Physical features of the region.

The total number of species of animals already obtained by us from deep water in this area is not less than 800. The number already identified or described, and entered on our lists of the fauna, is about 650. This number includes neither the Foraminifera nor the Entomostraca, which are numerous, and but few of the sponges. Of this list, less than one-half were known on our coast before 1880, and a large number were entirely unknown to science. Of fishes there are, perhaps, 70 species. Of the whole number, already determined, about 265 are Mollusca, including 14

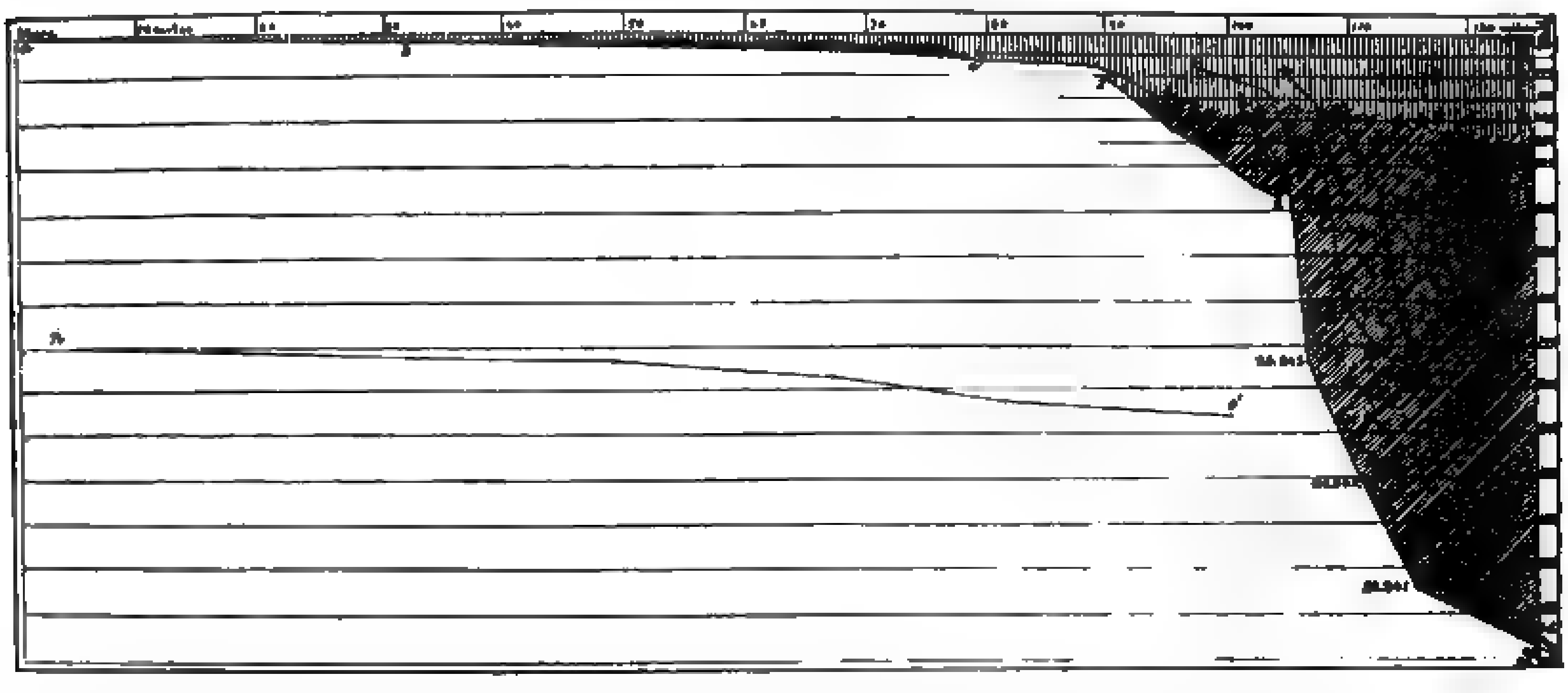


DIAGRAM 1. — To illustrate the relative slope or profile of the bottom, from the shore to the Gulf Stream slope, and across portions of the slope in several lines. Vertical to horizontal scale, 1: 300. The line n'–o' shows the actual slope along the line n – o. The vertical shading indicates the position of the comparatively warm water, both of the surface and of the Gulf Stream; oblique shading to the right indicates the cold water of the shallow plateau; oblique to the left, the cold water of the greater depths.

depths are mostly between 65 and 700 fathoms. Probably no other equally large part of the ocean basin, in similar depths, has been more fully examined than this. In addition to the Cephalopoda; 90 are Crustacea; 60, Echinodermata; 35, Anthozoa; and 65, Annelida.

The apparatus used on the Fish Hawk has been better in many respects than most other

vessels engaged in such work have had. Each year new improvements have been made. The 'trawl-wings,' first introduced by us in 1881, have been used with great success; for they have brought up numerous free-swimming animals from close to the bottom, which would not otherwise have been taken. The use of steel wire for sounding, and of wire rope for dredging, has enabled us to obtain a much greater number of dredgings and temperature observations than would have been possible under the old system of using rope, employed even on the Challenger. The use of steel-wire rope for dredging, first invented by Mr. A. Agassiz, and very successfully employed by him on the Blake, has proved to be an improvement of very great value in deep water. By its use there is an immense saving of time, and consequently a great increase in the value of the results. As an illustration of the rapidity with which dredging has been done on the Fish Hawk by using the wire rope reeled upon a large drum, I give here memoranda of the time required to make a very successful haul. In 640 fathoms, at station No. 1124, the large trawl was put over at 4.29 P.M.; it was on the bottom at 4.44, with 830 fathoms of rope out; commenced heaving in at 5.17; it was on deck at 5.44 P.M.; total time for the haul, 1 hour and 15 minutes. The net contained several barrels of specimens, including a great number and large variety of fishes, as well as of all classes of invertebrata, — probably more than 150 species altogether, many of them new.

At all the localities that we have examined, the temperature of the water, both at the bottom and surface, was taken, as well as that of the air. In many cases, series of temperatures at various depths were also taken. Many other physical observations have also been made and recorded. Lists of the animals from each haul have been made with care, and arranged in tables, so far as the species have been determined up to date.

South of New England the bottom slopes very gradually from the shore to near the 100-fathom line, which is situated from 80 to 100 miles from the mainland. This broad, shallow belt forms, therefore, a nearly level, submarine plateau, with a gentle slope seaward. Beyond the 100-fathom line the bottom descends rapidly to more than 1,200 fathoms into the great ocean-basin, thus forming a rapidly sloping bank, usually as steep as the slope of large mountains, and about as high as Mount Washington, New Hampshire. This is well shown by diagram 1, which illustrates the relative slope at several lines of dredging, and the *actual* slope $n'-o'$ along the line $n-o$. We call this the Gulf Stream slope, because it underlies the inner portion of the Gulf Stream all along our coast, from Cape Hatteras to Nova Scotia. In our explorations a change of position of less than 10 miles, transverse to the slope, sometimes made a difference of more than 3,500 feet in depth.

[*To be Continued.*]

THE INTERNATIONAL FISHERIES EXHIBITION.

It is just thirty-two years, nearly the third part of a century, since international exhibitions were inaugurated. The 'Great exhibition' of 1851 marks an epoch in the history of England. It brought with it new aspirations for culture, and new methods of education in science pure and applied, in the arts aesthetic and industrial, arousing them to a new intellectual life. "The Great exhibition of 1851," remarks a popular novelist, a social philosopher as well, "did one great service for country people: it taught them how easy it is to get to London, and what a mine of wealth, especially for after-memory and purposes of conversation, exists in that big place." It gave them the great treasure-houses of South Kensington, and the smaller kindred museums in all parts of the United Kingdom.

The world at large has profited by the same experience, though perhaps to a less degree. Every nation, almost every great city, has had its 'world's fairs,' and, according to its capacity, has profited by their lessons. It is doubtful whether we shall ever see another universal exhibition so extensive as those of Philadelphia (1876), of Vienna (1873), and of Paris (1867). The ideal has become too lofty; and the exhibition of to-day, like the worker, must be devoted to a specialty. The fisheries exhibition, soon to open at South Kensington, is as nearly as possible upon the site of the exhibition of 1851, and covers precisely the same area of ground; namely, twenty-one acres. It would be instructive to estimate how large an extent of territory would be covered by an exhibition in which should be represented, with the minuteness of to-day, all the divisions of the classification of 1851, — a classification, which, for minuteness, comprehensiveness, and philosophical system, has not since been equalled. An entire English shire would hardly suffice.

Special exhibitions have probably entirely superseded those of general scope, and their number is yearly increasing. In one year, re-

cently, the government of Austria participated in fifteen. Amsterdam, Zurich, Lisbon, Hamburg, Vienna, Madras, and Tokio, among others, have exhibitions of varying scope now in progress, or soon to open.

The fisheries exhibition is an institution at the success of which even the most sanguine seem to be astonished. No one has yet propounded a theory which explains satisfactorily the reason why these exhibitions succeed, yet succeed they do, perhaps more fully than special exhibitions of any other kind; and, moreover, they seem to enlist the interest of a larger number of scientific workers than do other exhibitions, though, of course, the electrical, geographical, and meteorological exhibitions are attractive in a higher degree to the students of those individual specialties.

The Berlin fisheries exhibition of 1880 was largely under the control of specialists in science. Among its most active supporters were men like Virchow, Peters, Magnus, Hilgendorf, Dohrn, Möbius, Von Siebold, Nitsche, Oscar Schmidt, H. A. Meyer, Wittmack, and Jäger, almost all of whom were on the board of direction; while, as commissioners and jurors, Italy sent Targioni-Tozzetti, Giglioli, Ricchiardi, Pavesi, Vinciguerra, and Cavanni, in short, all her marine zoölogists; Bohemia, Fritsch; Denmark, Lütken; Russia, De Solsky and Grimm; Norway, Raasch and Collet; and Sweden, Smitt, Thorel, and Malm. It is not difficult to understand why a statesman, diplomatist, and political economist like Professor Virchow should be willing to give up his days and nights for two months to committee and jury meetings, when it is remembered how much stress Germany places upon all which relates to the food-supply and the economy of all natural resources; but other interests must have influenced men like Von Siebold and Peters.

A similar array of names known to science appears in the prospectus of the London exhibition. Among the vice-presidents are the Duke of Argyll, Lord Walsingham, Sir John Lubbock, Professor Huxley, Dr. Gunther, and Mr. Spottiswoode, several of whom, together with Professor Flower, Mr. Robert H. Scott, Sir Philip Cunliffe Owen, and Mr. Saville Kent, are members of the general committee. It seems a little remarkable, however, to see the name of the president of the Royal society standing at the very tail of the list of vice-presidents, followed only by "The prime warden, wardens, and court of assistants, of the fishmongers company." At the other extreme is placed H. R. H. the Duke of Edinburgh. James Russell Lowell, Esq., is also a vice-president, his name standing between those of the Duke of Westminster and the Marquess of Salisbury.

Among the foreign commissioners are Prof. F. A. Smitt of Stockholm, R. Trybom of Lund, and Dr. Malm of Gothenburg, Professor De Solsky of St. Petersburg, Professor Hubrecht and Baron Von Hert of Utrecht, Professor Giglioli of Florence, Professor Nitsche of Tharandt, and Dr. M. Lindeman of Bremen. Surgeon-Gen. Francis Day is acting as commissioner for India.

An examination of the classification of the exhibition discloses the nature of the tie which binds together the varied interests represented in the lists of names which have been quoted. The ethnologist and the mechanician, as well as the fisherman, are concerned in the 'fishing-gear and the fishing-craft of all nations;' the meteorologist and the pharologist, as well as the philanthropist, in the 'life-saving apparatus of all kinds;' the physicist, as well as the navigator, in the "compasses, barometers, telescopes, lights, lamps, fog-horns, systems of signalling, electric lights, luminous paint and other equipments of fishing-vessels," and in "methods of communication from the shore to lightships and fishing-fleets by submarine cables, telephone, or other means of signalling;" while the geographer and geologist find something to interest them in the charts and relief-models of the ocean and its bottom. The chemist, the sanitarian and physiologist, as well as the merchant, transporter, and manufacturer, are touched by the section which illustrates the preparation, preservation, and utilization of fish, and the food, apparel, and dwellings of the fishermen. The jurist, the statesman, and the historian may study the "History and literature of fishing, fishery-laws, and fish-commerce." Biologists of every class must study classes IV. and V.; for the word 'fish' is broadly interpreted, and is held to signify any creature living in the waters: to wit, as enumerated, *a*, Algae, to be arranged under genera and species, with localities appended; *b*, sponges in their natural state; *c*, corals in their natural state, polyps, jelly-fish, etc.; *d*, entozoa and epizoa; *e*, mollusca of all kinds; *f*, star-fishes, sea-urchins, holothurians; *g*, worms used for bait, or noxious; leeches, etc.; *h*, perfect insects, and larvae of insects, which are destroyers of spawn, or serve as food for fish; *i*, crustacea of all kinds; *k*, fish of all kinds; *l*, reptiles, such as tortoises, turtles, terrapins, lizards, serpents, frogs, newts, etc.; *m*, aquatic and other birds hostile to fish or fishing; *n*,

aquatic and amphibious mammalia (otters, seals, whales, etc.), and others detrimental to fish. As if this were not sufficiently catholic, division 40 is a trap to catch any interests not already retained. It is defined as follows, under the head 'scientific investigation:' physico-chemical investigation into those qualities of salt and fresh water which affect aquatic animals; investigation of the bottom of the sea and of lakes, shown by samples; aquatic plants in relation to fishing, etc.; researches into the aquatic fauna (animals of the several classes preserved in alcohol, or prepared, etc.); apparatus and implements used in such researches.

Ten of the twenty-three subjects announced for the essays are purely biological, and many of the others can be handled only by scientific investigators.

The fisheries exhibitions of to-day are therefore more than their names would seem to indicate. Perhaps they might more appropriately be called hydrological exhibitions. Their scope has increased as they have become more popular. The first, held at Amsterdam in 1861, was much less ambitious. Others followed at Bergen, Norway (1865), Arcachon, France (1866), Bologne (1866), The Hague (1867), Aarhuus, Denmark (1867), Vienna (1867), Gothenburg, Sweden (1867), Havre (1868), Naples (1871), Berlin, London (1878); and in Berlin, in 1880, the climax was apparently reached in a display, which, for extent and completeness, no one supposed would ever be surpassed. Great Britain has since had exhibitions at Edinburgh, Norwich, and Tynemouth; and attention of the whole nation is now concentrated upon the exhibition which is to be opened by the Queen on the 12th. It is generally admitted that it is the most important exhibition held here since the Great exhibition of 1851. Twenty-five nations and colonies are represented. In the catalogues and in the announcements the place of honor is given to the United States; and the officers do not hesitate to admit that the success of the affair was largely assured by the prompt and liberal action of our government, — action which may be regarded as, in part, an acknowledgment of the very generous manner in which England participated in our own exhibition in Philadelphia in 1876.

South Kensington, May 1. G. BROWN GOODE.

THE WEDGE-PHOTOMETER.

THIS instrument has been attracting considerable attention during the last year, and has been especially studied by Professor Pritchard of Oxford and Professor Pickering of Harvard, to each of whom we owe a form of the instrument. It depends for its efficiency on the accurate observation of the time of extinction of the light of a star; and as it is evident that the various sources of error in photometric work — moonlight, the state of the atmosphere, the condition of the eyes of the observer, the position of observation, whether that of comfort or constraint — would affect a faint point of light near extinguishment more than they would the brighter lights used in other photometric methods, any contribution to the question of the accuracy to be expected from the wedge-photometer may be of interest.

The instrument employed by me is of the form suggested by Professor Pickering. It was made by Mr. J. Grunow of New York, and seems to be very good work. It consists of a wedge of London smoke glass an inch square, and about a twentieth of an inch thick at its blunt edge, a large low-power positive eye-piece, and a special adapter, and is a very convenient photometer to use. The color of the wedge is deep enough to give one magnitude of the ordinary scale of the brighter stars for each five seconds in the time of extinction at the equator.

For the study of the accuracy of observation with this instrument, I selected the Durchmusterung star 22°.2164, of which Argelander puts the magnitude at 5.3. In observation I took alternate observations on this, and the star to be compared with it, until I had five for each star, which I called a set of observations. By this method I made the conditions of observation as nearly as possible the same for the two stars, and thus the difference in their time of extinction nearly free from error.

My comparisons were made chiefly with the star Durchmusterung 22°.2163 of the catalogued magnitude 8.8. Between April 2 and April 29 I made twenty-eight sets of observations on the two stars. The difference in their time of extinction varied from 19.1 seconds to 21.6 seconds; approximating, however, pretty closely to the mean 20.6 seconds, of which the probable error was ± 0.09 in seconds, equivalent to ± 0.015 in magnitudes. The mean error of a single set of observations is ± 0.68 seconds, or ± 0.12 magnitudes. A series of four sets of comparisons of star 21°.2156 gave a mean error of ± 0.68, and a probable error of ± 0.23; and a series of five sets with 21°.2156 gave ± 0.83 and ± 0.24, in both cases in seconds.

These observations were made under various conditions with no more than usual care, and probably represent fairly the accuracy easily attainable. With further practice the errors could probably be reduced. In general, my observations seem to show that single sets of observations by this wedge-photometer are trustworthy to one or two tenths of a magnitude. If so, there is much that can be done by it; and as the simplicity, convenience, and inexpensiveness of the instrument are such as to recommend it, similar instruments could properly be a part of the outfit of every observatory.

The above errors are correct on the supposition that none of the stars examined were variable; and I found no evidence that they were. In the case of another star, however, either the star was variable, or the errors made were much larger than in the other cases, though the observations were made at about the same time. The star in question is 22°.2162. The average difference between it and 22°.2164 is 25.1 seconds for twenty-three sets; but the individual sets range from 28.0 seconds on the 15th, at 13h. sidereal time, to 22.3 seconds on the 19th, at 12h. The mean error of a single set is 1.34 seconds, and the probable error of the mean, ±0.58 second. As I believed I could trace with the eye a change in the brightness of the star, I think we have in this case a variable, with a range of about one magnitude, rather than observations much less accurate than others taken at the same time. M. W. HARRINGTON.

NOTES UPON THE FOETAL MEMBRANES OF THE OPOSSUM AND OTHER MARSUPIALS.

I RECENTLY had the good fortune to receive from Mr. Robert Speir of South Orange, N.J., a female opossum which had been captured within a few days after impregnation. I was thus enabled to make very satisfactory observations upon the foetal membranes, about which there has been so much uncertainty for many years. These embryos were in an early stage of growth, and, although they plainly showed very novel and unexpected features, no positive conclusions could be reached as to their later development. At this point a correspondence with Professor Wilder of Cornell resulted in his very generously sending me a quantity of marsupial material which he had procured from Australia. Among this material was a nearly perfect foetus in a late stage of development. An examination of this fully confirmed the observations upon the opossum embryos, and showed the relations of the foetal membranes at a later period. More recently Professor Chapman, of the Jefferson medical college, has kindly allowed a thorough examination of a valuable kangaroo foetus in his possession, which he has described in the proceedings of the Philadelphia academy for 1881. This foetus was in a stage intermediate between that represented by the opossum embryos and that of the foetus sent me by Professor Wilder: it showed the same features as the other specimens in an intermediate stage of growth.

In all these specimens the membranes are arranged very much as those of a kangaroo foetus which Professor Owen described in 1833. The peculiarity of the foetal membranes of this animal, which has ever since been used as a basis of classification distinguishing the marsupials from the higher mammals, is, that the allantois never attains a very great size, so that nothing like an allantoic placenta is formed; and the function of absorbing the maternal nutrition, during the short period of intra-uterine life, has always been considered to have devolved entirely upon the yolk-sac. Professor Owen, in the older of the specimens which he examined, found that the membranes were arranged as follows:[1] the foetus was enveloped in a large subzonal membrane, with folds fitting into uterine furrows, but *not adhering to the uterus, and without villi;* the embryo was enveloped in an amnion reflected over the stalk of the yolk-sac. This sac was large and vascular, and was connected with the foetal vascular system by a vitelline artery and two veins. There was a small allantois supplied by two allantoic arteries and one vein: it was quite free, and not attached to the subzonal membrane. The area of attachment of the yolk-sac to the inner surface of the subzonal membrane formed a disk bounded by the sinus terminalis, or circular venous trunk. When spread out, therefore, the yolk-sac formed the figure of a cone, of which the apex was the umbilical cord, and the base the sinus terminalis.

These valuable observations were confirmed by Professor Chapman in his paper referred to above. They are accurate so far as they go; but they leave us in doubt as to the real relations which exist between the foetus and the mother, inasmuch as they give no clew to the manner in which the embryo is nourished during its intra-uterine life, — a period of about

[1] This description is largely taken from Balfour's Comparative embryology, vol. ii. p. 199.

seventeen days in the opossum,[1] and thirty-eight days in the kangaroo.[2] My fortunate discovery of the early opossum embryos, and the subsequent examination of the two other marsupials, seem to throw a great deal of light upon this question, if they do not actually solve it. The principal facts which have been brought out may be briefly stated.

1. In the opossum the yolk-sac spreads out over about one-third of the inner area of the subzonal membranes, and forms a highly vascular disk, the *false chorion* of the placental mammals. This disk is ventral to the embryo; and among the numerous embryos which were examined *in situ*, these disks were found to be *invariably placed in a long uterine furrow*, while the remainder of the enveloping membrane floated free in the cavity of the uterus. The use of the word 'attachment' would be misleading in this connection, as a slight touch with the needle was sufficient to remove the embryos from their position. The outer surface of the subzonal membrane, all over the area to which the yolk-sac was adherent, was found to be covered with minute villi, which were just visible to the naked eye. These villi are simple upgrowths of the subzonal epithelium, shaped like little hillocks, and confined to this area. At this early stage they are hollow.

2. In Professor Wilder's specimen,[3] villi were found to be scattered over the same area of subzonal membrane; but in this case their development had proceeded much farther, and, although they were extremely minute, each was found to be provided with a solid papilla, which arose from the epithelium of the yolk-sac. A closer examination showed that the cap of subzonal epithelium was composed of flattened cells, and that the papilla was provided with capillary branches derived from the vessels of the yolk-sac. These villi conform, therefore, to what Professor Turner has described as the simplest type of allantoic villi, the nearest approach to which, among the placental mammals, is found in the pig.

3. In the kangaroo foetus the villi could be seen without a lens. They were, however, so minute, that it is not at all surprising that they have been overlooked hitherto. They were spread over the highly vascular portion of the yolk-sac, which is loosely attached to the subzonal membrane. A close examination into their structure has not yet been made.

[1] See Bachman, Proc. acad. nat. sciences Philad., 1848, 44.

[2] See Owen, Comp. anat. and phys. of the vertebrates, iii. §400.

[3] The genus cannot be ascertained, owing to a misplaced label. The foetus undoubtedly belonged to one of the smaller Australian genera.

4. The allantois in the opossum embryos was found in various stages of growth, but in none was it attached to the subzonal membrane. In Professor Wilder's specimen it was highly vascular, and appeared to show a ***disk-like area of attachment to the subzonal membrane***. This area showed no traces of villi. The subzonal epithelium consisted of flattened cells. In the kangaroo it was an extremely small vascular sac.

5. Owing to an accident, one horn of the uterus in which the embryos were preserved *in situ* was destroyed, so that no satisfactory study of the uterine wall could be made.

The presence of villi over that portion of the subzonal membrane which is in contact with the uterine wall renders it highly probable from analogy that minute crypts are present upon the latter. At all events, we now have data sufficient to establish the following facts: that the so-called *false chorion* of some of the lower orders of placental mammals, formed by the spreading of the yolk-sac over the inner surface of the subzonal membrane, in the marsupials functions as a *true chorion*, developing simple villi, by which the maternal and foetal blood-vessels establish a feeble interchange: in other words, the functions of the allantois in the placental mammals are, in a rudimentary way, performed by the yolk-sac in the marsupials. Finally, some genera of the marsupials probably show the attachment of the allantois to the subzonal membrane, which is the first step towards the establishment of an allantoic placenta.

These facts naturally give rise to a number of interesting questions, which will be discussed in a paper to be published in the *Quarterly journal of microscopical science* for July.

I wish to express my indebtedness to Professors Wilder and Chapman, without whose aid these observations would have been very incomplete. HENRY F. OSBORN.

Morphological laboratory,
Princeton, May 11, 1883.

RAINFALL AT PANAMA.

IN the *Comptes rendus* for Feb. 26, M. de Lesseps publishes some interesting observations of rainfall for four years (1879–82) at the Isthmus of Panama. The accompanying table gives these observations, together with like observations at stations along the Pacific coast, which are added for the purpose of comparison.

M. de Lesseps remarks that the rainy season lasts about six months, from May to November, with an interruption at the end of June and beginning of July. He assigns as a cause for these peculiarities the advance of the (overhanging) sheet of rising air which

Table of rainfall at Panama and other stations.

	Panama, lat. 9° N., long. 80° W.					San José, lat. 10° N., long. 84° W.	Mazatlan, lat. 23° N., long. 107° W.	San Diego, lat. 33° N., long. 117° W.	S. Francisco, lat. 38° N., long. 122° W.	Portland, lat. 46° N., long. 123° W.
	1879.	1880.	1881.	1882.	Mean, 4 years.	Mean, 2 yrs.	Mean, 2 yrs.	Mean, 7 yrs.	Mean, 7 yrs.	Mean, 7 yrs.
	"	"	"	"	"	"	"	"	"	"
January	0.04	1.89	0.16	0.00	0.52	0.22	1.74	1.72	6.61	4.98
February	2.52	.12	.16	.12	.73	.00	.00	1.55	4.34	8.78
March	5 71	.16	.35	.00	1.56	1.00	.00	1.21	3.45	7.87
April	5.55	1.61	3.23	.98	2.84	4.20	.00	.95	2.38	2.91
May	10.28	4.45	10.35	5.24	7.58	7.44	.00	.19	.64	2.90
June	6.46	5.00	13.78	6.18	7.86	6.23	2.12	.06	.26	1.81
July	7.91	9.88	7.20	5.35	7.58	10.30	10.16	.03	.01	.74
August	7.24	11.46	4.49	4.06	6.81	5.16	9.14	.08	.00	.91
September	9.02	7.91	8.94	4.06	7.48	9.14	15.96	.07	.14	1.99
October	9.80	11.81	9 69	6.69	9.50	10.02	3.26	.46	1.29	4.51
November	19.21	6.46	9.72	10.91	11.58	2.87	.80	.90	3.08	8.83
December	.98	5.51	2.48	2.01	2.74	.88	3.06	2.43	3.50	7.46
Year	84.72	66.26	70.55	45.60	66.78	57.46	46.24	9.65	25.70	53.69

accompanies the curve of maximum daily temperature due to the annual oscillatory movement of the thermal equator. The movement of this curve is closely connected with the annual movement of the sun across the geographical equator. The sun passes the zenith of the isthmus at mid-day twice in the year, on April 13 and Aug. 29. The sheet covers the isthmus from the beginning of May to the end of June, and from the end of July to the beginning of December. These two intervals occurring between the first of May and the first of December constitute the rainy seasons. The first is generally interrupted by the short 'summer of St. John.' During the remainder of the year is the dry season. At this time the sheet is entirely to the south of the isthmus, while during the 'summer of St. John' it is entirely to the north.

On the north side of this sheet the trade-winds of the northern hemisphere prevail, which, at the isthmus, have in general a direction from the north-east. On the south side the trades of the southern hemisphere prevail, which have a direction from the south. In the interior of the sheet, at the earth's surface, the wind is feeble and uncertain. This, then, for the isthmus, is the period of calms, the time of gentle breezes; now from the land, now from the sea, according to the hour of the day.

Percentage of precipitation in each month.

	Panama.	San José.	Mazatlan.	San Diego.	San Fran'co.	Portland.
January	1	0	4	18	26	9
February	1	0	0	16	17	16
March	2	2	0	12	13	15
April	4	7	0	10	9	6
May	11	13	0	2	2	5
June	13	11	5	1	1	3
July	12	18	22	0	0	1
August	10	9	20	1	0	2
September	11	16	34	1	1	4
October	14	17	7	5	5	8
November	17	5	2	9	12	17
December	4	2	6	25	14	14
Total	100	100	100	100	100	100

M. de Lesseps further remarks, that one can see, that, in the time during which the (overhanging) sheet of ascending air is over the isthmus, the season of rain prevails, because the trade-winds, blowing along the ocean's surface, accumulate in this sheet a mass of vapor, which rises up, comes to the higher regions of the atmosphere into lower and lower temperatures, and is condensed; producing, thus, a vault of perpetual cloud, which generally surrounds the earth in a dark ring, — called, by the French sailors, '*pol au noir;*' by the Americans and English, 'cloud ring,' — and continually precipitates during the rainy season the showers of the tropical regions.

The waters of the gulf-stream which come from the equator are charged with a great quantity of vapor; and this is condensed and precipitated by the Cordilleras. This accounts for the abundant rains of the Atlantic watershed. This cause does not exist on the Pacific watershed. The general current along the coast of the isthmus is just the reverse of that in the sea of the Antilles. On the contrary, the tide comes from the north; and in consequence these waters are cooler, and furnish less vapor to the air flowing along the surface. This explains why it rains more at Colon than at Panama, and why, in proportion as one removes from the Atlantic coast, the rain diminishes. So upon the island of Naos, situated in the Bay of Panama; and, where the canal company has established a meteorological station, the rain gathered is less than at Panama.

The existence of winter and summer rains in belts approximately parallel to the equator has been long recognized. A glance at the table above will show that the rains all along the Pacific coast are markedly periodic, and occur later in the year as we go north; and the heavier rainfall occurs at the time the sun is the farthest south of the equator.

H. A. HAZEN.

THE COPPER-BEARING SERIES OF LAKE SUPERIOR.

IT may not be unprofitable, at this presumably the closing stage of the present discussion of the Keweenawan series, to state summarily the main grounds on which its pre-Potsdam age is maintained. It is obvious that such a statement can but imperfectly indicate the nature of the evidence relied upon; for the significant data are derived from numerous localities, and from diverse phenomena which cannot be adequately, and at the same time briefly, described. The formation involves an area of upwards of forty thousand square miles; and only a wide survey of it, a critical elaboration of trustworthy observations, and a judicial treatment of the evidence, can command complete deference, and that is a thing of the future. No

one has seen the formation in its entirety; and only one investigator has approached to a general familiarity with it by personal study, and his more comprehensive results are not yet before the public. I have even hesitated on this account to offer this summary, having myself visited only seven of the significant districts outside of Wisconsin, with the investigations within which I have, of course, been intimately familiar, as also with the results of Professor Irving's more extended studies, which are herein somewhat drawn upon.

Brevity requires the omission of citations and authorities in the main.

The general stratigraphical facts which are not open to reasonable question are these: 1. Around the edges of the great depression occupied by Lake Superior lies an immense series of interleaved igneous and detrital beds, dipping inward toward a synclinal axis, lying mainly beneath the lake, but stretching landward across north-western Wisconsin; 2. Both within and without this basin are horizontal series of sandstones, each of which is traceable into contact with the dipping series at a few points, and into approximate junction at several others. The horizontal sandstone on the outside contains primordial fossils, and has long been known as Potsdam. The horizontal sandstones within the trough, unfortunately, have not yet yielded fossils of any positive character. Some of these are so situated that they might be supposed to be portions of the synclinal fold, but the greater part are not so placed as to admit of this interpretation.

Now, those who advocate the distinctness of the Keweenaw series maintain that the great tilted group of interbedded igneous and detrital rocks which constitute the copper-bearing formation belongs to an entirely different age from the horizontal sandstones without, and from most, but not all, those within. They offer, among other considerations, the following classes of evidence in support of their view: —

1. First and weakest, *the general stratigraphical relations above indicated.* — These afford at least a presumption of distinctness. This admits of easy verbal objection, and to those personally unfamiliar with the *tout ensemble* of the problem and its data, and with the methods Nature habitually pursues in distinction from those she might be imagined to pursue, can have but little force; but experienced stratigraphists will appreciate the fact, that great differences in the attitudes of closely associated strata, especially if otherwise differentiated, are usually indicative of differences in age, and that definite evidence of unity is required to justify the somewhat violent dynamics necessary to otherwise explain these diverse attitudes. This is especially true when the surrounding region is altogether devoid of evidence of disturbance during the supposed period of disruption. Not only in the immediate vicinity, but throughout the interior, there is an absence of evidence of more than the gentlest oscillations in the recognized primordial strata; while the Keweenaw series suffered a depression of more miles than it would seem judicious to estimate here, and embraces one of the most stupendous series of eruptions known to early geological history. Upon this argument, being a general one, we do not much insist. It gains force, however, in connection with the following points, and gives especial significance to the next.

2. *Differences in thickness.* — The recognized Potsdam strata in the adjacent region have been penetrated at numerous points by artesian wells, and are only rarely found to reach a thousand feet in depth. On the other hand, the thickness of the Keweenaw series is so enormous as to have led to a studied watchfulness for possible sources of error of estimate. Unless faults be assumed where there is no proof of them, the maximum thickness must be upwards of forty thousand feet, of which about fifteen thousand feet are detrital. Without insisting in a controverted matter, that this estimate may not be too high, owing to undiscovered faults, it remains that an enormous difference is absolutely demonstrable. Now, this great difference means something in the mere matter of accumulation, but great stress is not laid upon this. Plausible, but really inapplicable, answers readily suggest themselves. If, however, it is insisted that the igneous eruptions furnished exceptional conditions for rapid accumulation, it will be freely granted, and even urged: but the great mass of the detrital beds were formed after the eruptions had ceased; and, besides, the fossiliferous Potsdam strata lie against the same rocks in the St. Croix region, and, if contemporaneous, should have been likewise favored in accumulation.

But whatever this incongruity of thickness signifies in the question of deposition, it is at least important in the interpretation of the discordant attitudes of the strata, and the adjudication of approximately observed, but not actually visible, unconformities. We hold that to be a violent structural hypothesis which assumes that portions of the same unmetamorphosed series are tilted at high angles, while, within a distance much less than the thickness of the formation, other portions lie undisturbed. That this extraordinary phenomenon should be several times repeated, in a region not otherwise characterized by more than broad open folds, seems to us incredible.

3. *Differences in constitution.* — The sandstones of the Keweenaw series are largely composed of grains of various *silicates* derived from igneous rocks; while the Potsdam, within as well as without the basin, is mainly *quartzose*, as shown by the investigations of Irving and Sweet. The former are manifestly derived, as maintained by these writers in common with others on both sides of the question, immediately from the igneous series, with relatively little wear or assortment. The latter are thought to have had wider sources, and to have been subjected to more erosion and winnowing; for even where in the vicinity of the igneous series they are still notably quartzose.

4. *Unconformity.* — While every unconformity has a significance, only those are urged in this relationship which seem to us to testify directly to the fact of a tilting of the great copper-bearing beds before the Potsdam sands were laid down upon and against their upturned edges. The cases of unconformity may be grouped in three classes: *a*, those actually observed; *b*, those in which the contact, though observed, is complicated with disruption; and, *c*, those in which the immediate junction is concealed, and the evidence is only approximate.

a. Of the first class are those of the St. Croix district, substantiated by the independent observations of Sweet in 1875, Strong in 1876 and 1877, Winchell at one or more dates unknown to me, and myself in 1876, 1879, and 1880. There are also here several cases of approximately visible junctions beside those actually seen. To us, the facts — which manifestly cannot be properly described here, but which are in a measure set forth in the Wisconsin publications — teach explicitly that the copper-bearing beds were not only formed, but uplifted and extensively worn into hills and valleys, before the Potsdam sands were laid down against and upon them. The full force of the evidence presented by this region can only be felt when a just appreciation of the facts is acquired,

and judicially considered in connection with the great mass of stratigraphical evidence with which it links itself, and of which it furnishes at once the key and clearest exponent.

From this decisive locality, there stretches away north-easterly, to Keweenaw Point, a belt of outcrops constantly maintaining the typical character, *bedding*, and *dip* of the Keweenaw series. Mr. Strong mapped no less than fifty-five exposed areas within the county in which occur the unconformities on the St. Croix (*Geol. of Wisc.*, iii.; *Atlas*, sheet xix.); and no concealed interval of so much as four miles occurs along the belt within thirty miles of the decisive locality. Throughout the whole broad belt to Keweenaw Point, occupying several thousand square miles, all the outcrops, numbered by hundreds, are of the Keweenawan class, and there are *none of any other kind*. This we conceive to be decisive evidence, notwithstanding some concealment from drift.

b. To the second class belong the unconformities of Douglas County, in the extreme north-western corner of Wisconsin, and those of the Keweenaw range of Michigan. In the former region, in a distance of twenty-five miles, there are four excellent sections across the junction-line. These have been described in detail, and illustrated by Sweet. On the one side, the Keweenawan beds dip from 35° to 50° southward, terminating northward in upturned, worn edges. Approaching these from the opposite direction are horizontal beds, which, at a distance from the contact, are simple sandstones, but, near the junction, become conglomeritic from material manifestly derived from the copper-bearing series. The beds are locally broken and bent upwards near the junction; but this, in our judgment, does not vitiate the evidence of unconformity at the time of deposition. We maintain that these sections afford strong evidence that the Keweenaw rocks were upturned before the flat-lying beds abutting against them were formed.

Upon the discussion of the controverted contact-line along the base of the great escarpment of Keweenaw Point, I will not here enter, partly because it might be useless without elaborate discussion, and partly because I could scarcely fail to trench upon data that belong to another. The whole region in controversy has recently been re-examined, and sketches carefully prepared, intended to show the exact facts exposed to observation, stripped of the bias of interpretation. Pending their appearance, I need only call attention to the fault-line long since claimed by Foster and Whitney to exist here, — a view in which several subsequent students of the region acquiesce, among them Irving and myself, with qualifications. Now, while the existence of this fault may be maintained consistently with the view that the flat-lying sandstones on the east are the equivalents of the uppermost beds of the tilted series on the west, and also with the view that the eastern sandstones were deposited unconformably against the cliff formed by the upturned beds, the faulting in this case being held to have previously taken place, it is altogether inconsistent with the view that the eastern sandstones pass continuously under the cliff.

c. Besides the above regions, which present more than a dozen separate localities of actual or approximate contact, several other districts afford strong evidence of unconformity, though they do not rise to actual, at least to ocular, demonstration. The more important are found on the upper St. Croix River, on the Snake and Kettle Rivers in Minnesota, and in the vicinity of Lake Agogebic, Michigan. These localities present horizontal quartzose sandstones, regarded as Potsdam, lying near upturned igneous and detrital silicate rocks, referred, on the basis of irrefragable evidence, to the Keweenawan series. The relations of these are so close, that all recent investigators who have examined them regard them as instances of unconformity between diverse formations, and find no other explanation consonant with the general geology of the region. It was my purpose to present the more significant facts relating to these little-known districts, upon two of which I have made unpublished observations; but space forbids. Let it be observed, however, that in all cases the upturned beds are distinctly Keweenawan in type, and are referred to that series on stratigraphical evidence, that, apart from controversy, would be accepted as conclusive, while all the horizontal beds, which are exhibited at eight separate localities, are quartzose, and definitely of the type referred to the Potsdam. We hold these to be facts of much significance as parts of the chain of evidence. The wide range of territory represented by these several cases of unconformity adds to their force as evidence of the distinctness of the formations.

5. *The inherent consistency of the view.* — The harmony of the foregoing evidences, drawn from diverse sources and from widely separated localities, and the mutual confirmation they lend each other, as well as their accordance with the entire phenomena of the region, are inherent arguments for the correctness of the whole.

6. *The dynamic simplicity of the view.* — No important orographic movements, beyond those that must be independently assumed to explain the attitude of the Huronian strata of the region, and such faults as there is independent evidence of, are invoked. On the other hand, an extraordinary amount of local faulting and disturbance seems necessary to the alternative hypotheses, and this notwithstanding the unmetamorphosed condition of the beds.

7. *The discovery by the United States geologists of a like series in the Grand Cañon of the Colorado.* — This, while not a direct argument, has an important collateral bearing on the question. By reference to p. 183 of No. 6 of this journal, it will be seen that a series remarkably similar to the Keweenawan in its essential characters occupies the same general position and attitude, lying in inclined, unmetamorphosed beds, unconformably below the upper Cambrian, and also resting unconformably upon the crystalline archaean series. The observations of Bell show a somewhat similar group bordering Hudson's Bay; but too little is yet known of it to indicate its true horizon. The ultimate acceptance of the Keweenawan group as the representative of an important period in geological history, will, of course, largely depend on the discovery of similar formations elsewhere, or the persistent failure to otherwise fill the gap between the Cambrian and Huronian.

T. C. CHAMBERLIN.

Washington, D.C., May 5, 1883.

LIQUEFACTION, VAPORIZATION, AND THE KINETIC THEORY OF SOLIDS AND LIQUIDS.[1]

THIS paper discusses at length the two kinds of vibratory motion which the molecule of a solid body may have, rotary and translatory. It is demonstrated that the mean kinetic energy of such an oscillatory

[1] Abstract of a paper presented by H. T. EDDY, Ph.D., University of Cincinnati, to the Section of physics and chemistry of the Ohio mech. inst., April 26.

motion as is possible for a molecule of a solid reaches a maximum value which can only decrease, whether the amplitude of the oscillation be increased or diminished, and that the only way in which it is possible to increase the mean kinetic energy of this kind of motion is to impart sufficient additional energy to change the motion into one of complete rotation. By such a process, greater freedom of motion is given to the molecules, and a large amount of energy becomes potential. This is regarded as explaining the phenomenon of liquefaction.

It is shown by an extended mathematical discussion of the cohesive forces and resistance to compression, by which molecules hold each other at mean fixed distances, that the mean kinetic energy of the vibration of molecules about their mean positions also has a maximum value which can only be increased by removing them to such mutual distances that the cohesive forces no longer act. In this process a large amount of energy also becomes potential. This is regarded as the rationale of the phenomenon of vaporization.

It is further shown, that, on this theory, it might very readily occur that the specific heat of a liquid should at first decrease, and then increase, as Rowland has proved is the case with water, but that the specific heat could not at last decrease.

The cause of the relatively large specific heat of most liquids is treated. It is shown that the distribution of rotary velocities in free rotation, such as the molecules of a liquid are supposed on this theory to have, is such that the atoms of some small per cent of the molecules in any given mass must be torn asunder. What per cent of the liquid may be thus dissociated will depend upon the temperature and constitution of the liquid; it being smaller for the simpler liquids, and increasing with the temperature. Electrolysis is an evidence of this action. Such dissociation sufficiently accounts for the generally high specific heats of liquids.

There is a general qualitative accordance of the theory with observed specific heats. A further confirmation of the theory is found in the clear explanation it affords of the existence of a critical temperature, above which a vapor is uncondensable by pressure alone; for, when the mean kinetic energy of all the molecules of a liquid acquires a value greater than the maximum possible in a liquid state, the liquid is not only vaporized, but necessarily becomes an uncondensable gas, and remains so.

GERMS AND EPIDEMICS.[1]

AFTER a brief historical sketch showing the idea that certain diseases, and especially marsh-fevers and the plague, are caused by the entrance of minute living organisms into the body, to be a very old one, but one which, until within a few years, has had no experimental proof, some definitions were given of the terms now used in discussion of this subject; and the word 'microdeme,' meaning 'little living thing,' was proposed as a general designation for the minute living particles found in almost all air or water. The microdemes include the *Microphytes*, or minute vegetable organisms, and the *Microzoa*, — the microzomes, the bacteria, microbia, micrococci, etc. There is at present no evidence that any microdemes are derived from any source other than other living organisms, nor that the special microphytes which cause the various processes known as fermentations or putrefactions ever develop into the higher forms of fungi; although this is still an unsettled question, and there is some reason to think that some of the higher fungi may act as ferments.

[1] Abstract of a lecture by Dr. J. S. BILLINGS, given in the Saturday course at the U. S. national museum, Washington, Feb. 17.

The prevailing opinion at present is, that there are many different kinds of microphytes, each having special powers, and that each can only propagate its own kind within a certain limited time.

But it is also probable, that by changes in nutriment, temperature, etc., changes in their habits and powers may be produced through natural selection. These changes are so considerable as to cause them to appear to be new species. The germ theory is, that certain diseases are due to the presence and propagation in the system of minute organisms which have no part in its natural economy. The word 'germ,' however, is often erroneously applied to independent organisms which originate outside of the body itself, such as the particles in vaccine lymph which are not microphytes, and can hardly be called independent organisms.

The diseases caused by large and comparatively well-known organisms are called parasitic. Such are some varieties of skin-disease; as ring-worm, or the so-called live spots, the fungus foot of India, and the disease of the ear due to the growth of a peculiar Aspergillus. A new disease of this kind is the so-called actinomycosis, due to a fungus which forms tumors near the angle of the jaw, and which causes death when it becomes generalized.

An account was then given of the organisms found in splenic-fever, relapsing-fever, chicken-cholera, leprosy, etc., and the method of Pasteur for the so-called attenuation of virus was described. This method appears to depend largely on the exposure of the broods of micro-organisms to the influence of oxygen; and recently MM. Nocard and Mollereau have announced that the same can be effected much more rapidly by the use of oxygenated water. The question as to whether Pasteur's inoculation with artificially modified virus will afford permanent protection is still unsettled, for sufficient time has not elapsed to decide it; but there is reason to hope that it will be found to be of great practical benefit.

The effects of microdemes in producing pyaemia and puerperal-fever are well described, and attributed to a poison secreted by them, of the nature of the so-called ptomaines, rather than to their mere mechanical presence. This knowledge is practically applied in what is called antiseptic surgery; and the surgeon now undertakes, without hesitation, operations which, twenty years ago, would have been deemed quite unjustifiable; for he knows, that by insuring that neither through the air nor the water, the sponges nor the instruments, nor in any other way, a single microdeme which has not had its powers of growth and reproduction totally destroyed shall gain admission to the wound, he need have no fear of blood-poisoning.

As regards diphtheria, it is probable that it is due to a common micro-organism, which, under circumstances not yet understood, becomes virulent, as the micro-organisms of common sweet-hay infusion may be transformed into those which cause malignant pustule.

The connection of consumption with a microphyte is still doubtful, though not improbable; and the same may be said with regard to malaria.

A sketch was then given of some of the characteristic phenomena attending the great epidemics. For some, the germ theory appears to afford the best explanation; for others, such as influenza or cerebro-spinal fever, this theory is quite inadequate.

Special attention was called to the many points in

which our knowledge of these subjects is still fragmentary and imperfect, — points which are to be settled by direct experiment. Such experimental researches are of the highest value; and it is much to be regretted, that while the governments of England, France, and Germany, are employing their leading scientific men in such work, Congress has deliberately stopped a most promising series of investigation of this kind, and has resolved to confine its efforts to paying bills after an epidemic has made its appearance.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Use of the moxa in Japan.

As I rode behind the naked-backed jinriksha coolies, I noticed along each side of the spine, from the head to the hips, white, irregular scars, about the size of a dime, indicating, as I supposed, some skin-disease, to which they are very subject from their diet and exposure when young. These were the marks left by the *moxa*, a household remedy, probably invented in Japan, — a painful and powerful agent, well known in modern surgery. It is made of the pith of a reed (Artemisia), mixed with powdered charcoal, in a conical form. This is ignited, applied to the skin, and allowed to burn slowly until extinguished. The flesh is severely burned, with the resulting scar alluded to. As if this were not sufficient to expel the 'winds and vapors,' which they and the Chinese believe to be the cause of all diseases, this is combined with acupuncture, the needle passing through the moxa deeply into the tissues, and conveying the heat to the supposed seat of disease. As they employ this every spring as a preventive measure, it is rare to see a coolie without these scars. The accoucheur calls it to his aid, and is directed to burn three cones on the little toe of the right foot to accelerate the operation of nature. Even infants are thus tortured. A child about three years old, suffering from a wasting diarrhoea, who had thus been uselessly tormented, was brought to me; the many wraps having been removed, a simple water dressing and mild opiate brought the little creature round all right in two days.

SAMUEL KNEELAND.

The least bittern in Newfoundland.

While on a recent visit to Newfoundland, I examined a mounted specimen of the least bittern (Ardetta exilis) that had been killed in a fresh-water marsh about a mile from St. John's, in the early part of October, 1882. The latitude of St. John's is 47° 33′ N., and it is hardly necessary to add that this species has not previously been recorded from so far north.

C. HART MERRIAM, M.D.

Locust Grove, New York.

Science for workingmen.

Your article in the number of SCIENCE for April 20, upon this topic, was timely and suggestive. The example offered by the Baltimore and Ohio railroad is indeed worthy of imitation. But such work, however novel it may be in the east, has been done to a greater or less extent in this state for several years. It may interest your eastern readers, who sometimes think that we westerners must always wait for them in such matters, to know of a few attempts here to do similar work for the working-classes. Three years ago the officers of the St. Louis and San Francisco railroad maintained, with the hearty co-operation of its friends, a course of lectures in at least one important town on its line of road, for the special benefit of the railroad employees.

Two winters ago the Crystal plate-glass company, whose works, situated about thirty miles from this city, bring about them a population of nearly fifteen hundred, arranged a similar course of instruction lectures, which were attended by audiences of six and eight hundred persons.

The president of the St. Joe lead-mines at Bonne Terre, about seventy-five miles south-west of St. Louis, has just begun a like work, and intends to provide a good course of practical lectures, or talks upon science, literature, and travel, for the coming winter.

At Bonne Terre and at Crystal City, reading-rooms and libraries have been opened for all who choose to avail themselves of such opportunities; and at the former place a public reading from some standard author is given every Friday evening. The results attending such efforts to help working men and women have been sufficient to encourage these and other corporations to go on to still better things. The knowledge conveyed, and impulse given to thought and study, are only a part of the good done. A better relation between employers and employed is sure to come from the good feeling which prompts such action, and the grateful appreciation with which it is received.

Washington university is in this matter willing to take the position assumed by Johns Hopkins university in Baltimore, and has some half a dozen or so among its busy professors who are always ready to respond heartily to such calls for help. This institution has, in fact, been the main dependence of the corporations above mentioned in their efforts to do something to entertain and instruct their people.

We have accomplished but little here yet, but it may not be amiss to put ourselves on record as having begun. It helps us, always, to know what others are trying to do.

M. S. SNOW.

Washington university, St. Louis, May 2.

Robins, sparrows, and earth-worms.

An amusing bit of impertinence on the part of the immigrant house-sparrow is seen in his habit of stealing earth-worms from our great lumbering, native American robin. As everybody knows, the robin is not a little skilful in extracting earth-worms from their burrows in land covered with short grass, as in pastures, lawns, and yards. The bird quickly detects the worm's head, as the creature lies resting near the mouth of its burrow, and seizes it instantly by a sudden blow with the beak. The head of the worm once firmly grasped, the robin straddles his legs apart, braces himself firmly, and gradually lifts his head to the uttermost, and thus slowly, by what is manifestly a powerful and a fatiguing effort, drags out the resisting worm. Having succeeded in an important enterprise, the bird very naturally pauses for a moment to take breath; and at this critical instant of time a sparrow steps forward, out of a squad of these birds which have been watching the robin's proceedings, quietly takes the worm from the robin's mouth, and incontinently flies away with it, leaving the original possessor in blank amazement. The transaction is well worth seeing for its own sake, and needs but to be looked for, in order to be seen frequently in and about our cities; and it suggests a question which may, perhaps, be profitably studied by the coming generation of naturalists. Indeed, the fact itself is worth putting upon record as a sort of bench-mark to serve as a point of comparison for observers in future years.

The fact being as stated, the question is, What is the tribe of robins going to do about it? It is idle to suppose that the whole race of robins will continue for long to 'get left' in this way, or that they will accept the sparrow's system of pillage as a finality, to be submitted to as a part of the fundamental plan of life in this best possible of worlds; and it will be of interest for future observers to notice in just what manner the conflicting interests of the two birds shall, in the fulness of time, have been composed. At least four lines of conduct would seem to be open to the robin: he might thwack the offending sparrow at the moment of his wrong-doing, or, indeed, all sparrows, both as a preliminary to the hunting of worms and on all convenient occasions, though these operations would doubtless be somewhat laborious; possibly he might learn to swallow the worm *instanter*, or perhaps even to fly away with it quickly enough to elude pursuit; or he may, in despair, wholly give up the pulling of worms. So far as my own observation goes, though it must be said that it has been confined to no great number of individual robins, it would seem as if no inkling of either of these plans has yet occurred to the suffering bird. In so far as I have myself seen, each particular robin, when thus defrauded, looks and behaves as if he did not clearly comprehend what had become of his worm; and he speedily goes in search of another, as if, on reflection, he had concluded that he must have himself swallowed the first. Meanwhile, a number of the sparrows who had flown off in chase of the first robber with intent to share his booty have returned, and are hanging around the robin in readiness for his second stroke. The probabilities that the robins will eventually find out some way of circumventing the thieving sparrows seem stronger when we reflect that it is probably only a very short time, comparatively speaking, since the robins began to pull earth-worms, anyway, and consider how thoroughly well they now do this work. To all appearances, a parcel of scattered robins hopping about in a pasture are attending to any thing but business. It is hard to believe, at first sight, that the birds are seriously searching for food; for each one of them is continually stopping and standing still in an apparently aimless way, as if distracted. In point of fact, the bird, when quiet, is intently watching for earth-worms in their burrows; and it is more than probable that he is not helped at this stage of proceedings by a group of sparrows hanging expectant about him. When the worm, or the place where the worm is, is perceived, the movements of the robin are sufficiently direct and forcible, as has just been stated. Inasmuch as there is good reason to believe that earth-worms were not to be found at all in this New-England country before its settlement, and that, even if they did exist, they were rare, it would seem that the robins must have learned the trick of capturing them within the last two hundred or two hundred and fifty years. Even if it be supposed that the earlier robins may have practised somewhat analogous movements with regard to certain kinds of insects or their larvae, it will still be reasonable to suppose that the first lesson, how to detect and pull the worm, must have been intrinsically harder than the one now before the robins of the period; viz., how to keep and hold the worm in spite of the pygmy sparrow. F. H. STORER.

Intelligence of the crow.

In SCIENCE, No. 13, is a letter with this title, which I read with much interest, for the story is a very pretty one, and it is too bad to disturb it; yet I can but think the writer mistaken in the bird, for he says, 'It seems that we had been strolling too near their nests in the walls.' Now, it is well-known that crows do not build in walls or cliffs; and none of the crows which I have ever kept in confinement ever used their claws with which to carry either food or other materials. I kept a raven for several years, which had its liberty, but always came for food when called. I never saw it carry food or any thing else in its claws. I have known it to carry off its own rations, rob both dog and cat of theirs, making at *least* three pieces, all of which it carried away in its beak at once, never in its claws. During the summer of 1882 I was living near high wooded cliffs, on one of which this raven built a perfect nest. It seems to me your correspondent must be mistaken.

Dorchester, Mass. JOS. M. WADE.

Sun's radiation and geologic climate.

In saying that the hypothesis of a diminution of solar radiation through the dissipation of solar energy would be admitted by 'most students,' I did not intend to include myself, for I am really a dissenter. In my judgment, the weight of the cumulative geologic evidence for the great age of the earth is not counterpoised by the arguments thus far adduced from the physical side of the question. I therefore welcome Mr. Warring's note (SCIENCE, No. 14) in that it helps to show that the physical conditions involved in the discussion are not so simple as some have assumed them to be. Perhaps we may go a step farther, and say, that even if it is demonstrated that solar energy is being dissipated, and if it is demonstrated that in consequence of this dissipation the temperature of the sun is either falling or rising, the relative intensity of solar radiation still remains an unsolved problem. The rate of radiation is a function of other conditions besides temperature, and notably of the nature of the outer envelope of the sun. It is quite conceivable that changes in the envelope, belonging to the chemical history of the sun, might materially modify any law of variation based upon a theory of progressive dissipation of energy. This suggestion is, of course, without experimental basis; but in this respect it does not stand alone. Our laboratories fall so far short of realizing solar conditions, that solar physics and solar chemistry cannot be conceived without the aid of the imagination.

G. K. GILBERT.

Marking geodetic stations.

Of the many hundred Coast-survey stations that have been marked at different dates within the limits of the state of New York, only a very small percentage have now, or ever have had, surface-marks of any description, and but few of the underground marks can be recovered without re-measuring angles of the triangulation.

The manner of marking stations is apparently left to the judgment of the Coast-survey assistants. The writer of the manual 'On the field-work of triangulation,' issued by the Coast-survey, neglected to place surface-marks at several of the primary triangulation points occupied by himself in the vicinity of Albany.

A substantial surface-mark has been placed at every geodetic station of the New York state survey; and although some have been mutilated, so far as is known, none have been removed. The number of granite surface-marks that have been placed by the survey is at present three hundred and twenty-nine.

HORACE ANDREWS, JUN.,
Albany, May 12, 1883. *Assistant N. Y. state survey.*

THE SYNTHESIS OF MINERALS AND ROCKS.

Synthèse des mineraux et des roches; avec une planche en photochromie. Par *F. Fouqué et A. Michel-Lévy.* Paris, *Masson*, 1882. 423 p. 8°.

THE great value of synthesis in any department of scientific inquiry is undoubted; but the difficulties connected with it are in most cases so discouraging, and the results obtained so unsatisfactory, that an additional interest attaches to experiments so brilliantly successful as those recently performed in Paris by Messrs. Fouqué and Lévy in the artificial reproduction of volcanic rocks. It is to the French that we owe almost every thing that has thus far been accomplished in synthetical mineralogy; and we can but hail with delight the achievements of these two gentlemen, who have added new lustre to the French name by carrying the synthesis one step farther. They have produced in the laboratory, not only a large number of the rock-making minerals, but have produced them in their natural associations, as they go to make up integral parts of the earth's surface.

The book before us is to a great extent a compilation, giving a bibliography, and a short *résumé* of the processes by which mineral species have thus far been artificially obtained. Valuable as this is for reference, it is in the first eighty pages of the work that its principal interest lies. Here we are presented with a systematic account of the authors' own experiments, which it has heretofore been very difficult to obtain from the numerous short articles scattered through various periodicals which have appeared during the past four years.

The first chapter is a general introduction, containing, first, the five conditions which an artificial product must fulfil in order to be a successful synthesis. Then are noted several circumstances, which, during late years, have been especially conducive to synthetical investigations in the department of mineralogy and geology, and the great benefit which these sciences have derived from such investigations. A classification of the various methods made use of in the artificial reproduction of minerals follows; and the chapter closes with an arrangement of the crystalline constituents of the earth's crust, for purposes in hand, in four categories, as follows: —

1°. *Volcanic* (basic) *rocks;* i.e., plagioclase rocks, and those free from felspar.

2°. *Acidic rocks;* i.e., those containing quartz or orthoclase (granite, rhyolite, etc.).

3°. *The crystalline schists* (gneiss, mica-schist, etc.).

4°. *Mineral veins.*

The minerals of the first of these categories, and their natural associations, have nearly all been reproduced by simple fusion; those of the last, by volatilization or solution. Those of the remaining two categories have not yet been artificially reproduced with entire success.

The second chapter is devoted to the account of the authors' own experiments, and a discussion of their results. This is preceded by a brief history of what had been before accomplished in this line. Attempts to reproduce mineral associations by means of superheated water had yielded nothing satisfactory, and even the method of pure igneous fusion, so often tried, had only produced results that caused the most eminent geologists, in most recent years, to declare that Nature must employ far different means in the formation of her lavas than stands at the command of the laboratory.

The apparatus with which the syntheses were performed was very simple. The substances to be fused were placed in platinum crucibles, incased in coverings of fireclay. These were heated by a blast of ordinary illuminating-gas in a Leclerc and Forquignon furnace. Four grades of temperature were made use of, designated by their numbers as follows: —

No. 1. Melting-point of platinum. Sufficient to reduce anorthite, leucite, and olivine to a vitreous mass.

No. 2. Melting-point of steel, also of all the felspars except anorthite, and of the bisilicates.

No. 3. Between the melting-points of steel and copper. Pyroxene and nepheline fuse readily.

No. 4. Where copper fuses with difficulty.

The associations of various rock-making minerals were readily obtained by the employment of the principle, already well known to Hall, *that the fusing-point of a crystallized silicate is in general higher than that of the same chemical compound in an amorphous state.* If, therefore, a melted silicate glass be held for a time at a temperature between the fusing-point of some mineral whose constituents it contain, and its glass, crystals of this mineral will form in the molten mass; now, if the temperature be lowered sufficiently, the next less easily fusible mineral may be obtained; and so on. It is then the rule that *the minerals crystallize out of the magma in the inverse order of their fusibility.* This rule is abundantly verified for the class of rocks capable of synthesis

by fusion, both by the study of natural and artificial products, with a few apparent exceptions, which receive a special explanation.

By a judicious combination of substances and temperatures, the authors succeeded in obtaining eleven distinct mineral associations, almost exactly reproducing, even in the minuest details of structure, as many natural rock types.

These are as follows: 1°. *Augite* (*oligoclase*) *andesite*, 2°. *Augite* (*labrador*) *andesite*, 3°. *Augite* (*anorthite*) *andesite* (all produced by single fusion at temperature No. 3); time three days. 4°. *Basalt*. Two successive stages of fusion were necessary to produce this rock. Temperature No. 2 produced in forty-eight hours numerous crystals of olivine embedded in a glassy matrix, which was altered into a crystalline mass of labradorite and augite microliths by being again subjected for an equal length of time to temperature No. 4. 5°. *Nephelinite* was produced in forty-eight hours at temperature No. 4. 6°. *Leucitite* was obtained after three days' fusion at temperature No. 2. 7°. *Leucititephrite* produced by double fusion exactly like basalt. 8°. *Lherzolite*, 9°. *Meteorites free from felspar*, and 10°. *Felspathic meteorites*, though quite successful so far as the mineral associations were concerned, showed certain variations from the natural products in their structure. No synthesis was perhaps so interesting as that of 11°. *Diabase*, with the so-called 'ophitic' structure. This structure consists, as is well known, of irregular masses of pyroxene filling the spaces between the lath-shaped crystals of plagioclase. It was found to be impossible to reproduce this structure with oligoclase or labradorite, on account of their comparatively low fusing-point. By means of a double fusion with anorthite, it was, however, successfully accomplished.

Scarcely less interesting than these positive results are the conclusions derived from the authors' negative experiments. It was found impossible to obtain the acid rocks, i.e., those containing either quartz, albite, orthoclase, muscovite, biotite, or amphibole, by purely igneous fusion. These minerals either produced an amorphous mass, or passed into other combinations giving rise to species already obtained; e.g., hornblende, when melted, crystallized as pyroxene. Thus the very important conclusion is reached, that the acid rocks owe their origin to some other agency than simple fusion.

Under the head of the synthesis of minerals, the authors' experiments in fusing mixtures of felspars are worthy of special notice as being directly opposed to the now generally accepted theory of Tschermak, that the triclinic felspars form an isomorphous series. Fouqué and Lévy found it impossible to obtain crystals of intermediate members, as only well-defined microliths of either oligoclase, labradorite, or anorthite, appeared, varying in their relative proportions with the mixtures fused. Also of especial interest are their artificial production of felspars with lead, barium, and strontian as bases.

THE GEOLOGY OF NATAL.

Natal. Department of mines. Report upon the coal-fields of Klip River, Weenan, Umvoti, and Victoria counties, together with tabulated statement of results obtained from a series of trials of colonial coal upon the Natal government railways. By F. W. NORTH. London, *Harrison, pr.*, 1881. 1, 66 p., (49) pl., etc. f°.

THIS report contains two maps, showing the distribution of the coal-fields of the colony of Natal, and a description of 72 sections occurring in them, 70 of which are illustrated by diagrams. There are also two horizontal sections given, — one from Buffalo River to the Drakensberg Mountains, and the other from Buffalo River to Elands Laagte.

Mr. North estimates the actual area of the Natal coal-field, where he has found workable coal-seams at the surface, at about 1,100 □ miles, situated entirely in Klip River county. To this he adds 250 □ miles for the region between the Ingagani River and the Drakensberg Mountains, which he considers the coal measures underlie. The workable seams vary from 4 to 10 feet in thickness, and are of several qualities. Assuming an average thickness of 4 feet, and allowing a deduction of 50 per cent for faults, worthless coal, and barren ground, he estimates the whole at 2,073,000,-000 tons, divided into, —

	Tons.
Anthracite, similar to Gladstone . . .	518,400,000
Semi-bituminous, similar to Walmesley,	518,400,000
Bituminous, similar to Dundee coal-fields and Lenox sections	518,400,000
Free-burning bituminous coal of the same character as No. 44 Crown lands and Lenoxton, Newcastle .	518,400,000
Total	2,073,600,000

Mr. North considers these coals superior in quality to those of Cape Colony. A number of analyses of them have been made by Dr. Frankland and Dr. Hahn. There are also many beds of iron ore: the one from Prestwick is an intimate mixture of magnetic iron ore and

brown iron ore, and yielded on analysis 63.51 per cent of metallic iron.

Accompanying the report is a "Horizontal geological section on the main road from Durban to Van Reenen's pass, by Dr. P. C. Sutherland." This, in so far as it covers the same ground, differs considerably from that published by C. L. Griesbach in 1871. The Table Mountain sandstone, referred by Griesbach to the carboniferous, is by Sutherland considered Silurian. The mesozoic eruptive rocks are joined together under the name of basaltic, and are apparently represented as dikes, and not as interstratified flows of melaphyr, amygdaloid, and aphanitic diorite, as by Griesbach.

Mr. North gives the following geological order of succession in the rocks of Natal: —

1. Basaltic trap rocks, often penetrating between stratified rocks or shales of the coal-measures, and forming horizontal beds.
2. Triassic horizontal coal-measures, containing coal-seams correlating with the Stormberg coal-field of Cape Colony.
3. Pietermaritzburg shales, probably corresponding with the upper Karroo beds of Cape Colony.
4. Conglomerate or bowlder clays, in all probability the Dwyka conglomerate of Cape Colony.
5. Sandstones, horizontal and massive, of the Inanda location, Table Mountains, and Bothas Hill, etc., probably of Silurian age.
6. Primary rocks, — granite, gneiss, marble, etc.

Mr. North seems to have overlooked the cretaceous series, from the lower greensand up to the white chalk described by C. L. Griesbach in south-eastern Natal; and no evidence is given for assigning the Table Mountain sandstone to the Silurian instead of the carboniferous: in fact, no notice whatever is taken of Mr. Griesbach's able work on the geology of Natal.

At the Insiswa Mountains, in the Amaponda territory, the line of demarcation between a vast eruption of igneous rock and the triassic contains various ores of copper containing traces of gold. Mr. Griesbach also mentions the occurrence of copper ores along the line of the eruption of melaphyrs. We have here, in another portion of the world, another instance of the occurrence of cupriferous traps in the trias.

The bowlder clay consists of a bluish gray base, so fine that its constituents are not resolvable except under high magnifying power, and then no crystals are disclosed. It appears to be a very fine indurated mud, containing bowlders, pebbles, angular fragments, and grains of a great variety of rocks varying in size from masses weighing over 5 tons to pieces smaller than a pea. In mechanical composition it greatly resembles the great Scandinavian drift. It stretches for hundreds of miles, and has been found 1,200 feet thick. Some of the larger angular bowlders seem to have been brought from a distance of at least 70 miles. It seems difficult to account for such a formation otherwise than by glacial action at the close of the dyassic period.

THE BIBLIOGRAPHY OF ANGLING.

Bibliotheca piscatoria. A catalogue of books on angling, the fisheries, and fish-culture, with bibliographical notes and an appendix of citations touching on angling and fishing from old English authors. By T. WESTWOOD and T. SATCHELL. London, *Satchell*, 1883. 397 p. 8°.

THE possibilities of the future in the formation of libraries on special subjects, at present rates and ratio of increase in book-making, are brought forward in a striking manner by examination of a list like that before us. Here is a work devoted to angling, fisheries, and fish-culture, in which 2,148 distinct publications are registered under 3,158 entries, inclusive of new editions and reprints. Angling occupies 245, fisheries 83, and fish-culture 23 pages. Roughly estimated, nearly ten per cent of the publications, including reprints, etc., have appeared since 1870. Fish-culture alone claims an increase of nearly one-third in the same time. It is hardly to be expected that a work of this character should be entirely exhaustive or complete. The authors deserve great credit for the nearness of their approximation to completeness, for the amount and quality of information given, and for general accuracy.

An example or two will indicate respects in which the book may be improved in future editions.

"*Gesner* (Conrad). Aqvatilivm animantivm nomina Germanica et Anglica, serie literarum digesta, authore Conrado Gesnero. [1530?] 8°. Appended to an edition 'P. Ovidii Nasonis Halieuticon, etc.' Tigvri apud Gesneros fratres, pp. vi+ 280, and extending from page 12 to 280. . ."

This should read, —

Gesner (Conrad). De piscibvs et aqvatilibvs omnibvs libelli III. Noui. Avthore CONRADO GESNERO Medico et philosophiae naturalis interprete in Schola Tigurina.

I. Scholia et emendationes in Halieuticon P. Ouidii Nasonis. [pp. 1–11.]
[Second title.] P. Ovidii Nasonis Halievticon liber.

II. Aqvatilivm Animantium Enumeratio iuxta Plinium, emendata et explicata serie literarum. [pp. 12–92.]
[Running titles.] Catalogvs Aqvatilivm, and Divisio Aqvatilivm.

III. Eorvndem Nomenclator Germanicus longe copiosissimus. Et alia quaedam ad Piscium historiam pertinentia. [pp. 93–280.]
[Running title.] Teütsche namen der Fische vnd Wasserthieren.
Tigvri apud Andream Gesnerum F. [Date of Prefaces 1556.]

In consequence of the foregoing, after *Ovidius Naso* (Publius), "Halieuticon: hoc est, de piscibus libellus, mute quam ante hac emendatior et scholiis illustratus . . . per Conradum Gesnerum. Tiguri apud Gesneros fratres [1530?] 8°" should give place to the following: Part I. of Gesner's De piscibvs et Aqvatilibvs, "Scholia et emendationes in Halieuticon P. Ovidii Nasonis." "P. Ovidii Nasonis Halieuticon liber." pp. 1–11. Tigvri apud Andream Gesnerum F. [1556.]

The date for the first Frankfort edition of Aldrovandi is 1623 instead of 1629; and Gronow gives that of the second as 1640 instead of 1645. That given by the latter as Venice, 1616, is omitted. Three editions of Aelian (1556, 1611, and 1616), given by some authorities, do not appear. Future revision of the work will probably introduce the names of such works as those of Schomburgk's Fishes of British Guiana (1852), and Spix and Agassiz' Fishes of Brazil (1829), both of which give information on angling. The latter figures on plates A to G the various methods of capture in use among the natives.

Our authors have given us a work of great importance to all interested in the subjects of which it treats.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Mass of a planet from observation of two satellites. — M. Struve recommends measurement of the positive angle and distance of a satellite from another satellite, and not from the primary planet. A series of such measurements on satellites of Jupiter has been begun at Pulkova. The observations occupy one-third the time, and are considered two or three times as accurate as those by direct reference to the centre of the planet. They are free, moreover, from the unknown constant errors inseparable from the latter, — an advantage which Prof. A. Hall, in this paper, considers cheaply purchased at the price of greater difficulties in computation. He shows, that, while the solution of six normal equations requires seventy-seven auxiliary quantities, that of twelve (the elements of both orbits being involved by the new method) requires four hundred and forty-two, and therefore nearly six times the labor. But these twelve equations give the period and mean distance of each satellite, and hence two values of the planet's mass. Mr. W. B. Taylor objected to such special designations as 'peri-Saturnian,' 'apo-Jovian,' for the apsides of satellites' orbits when general names were needed. He suggested 'peri-apsis' and 'apo-apsis.' — (*Phil. soc. Wash., math. sect.; meeting* April 26.) [919

Periodicity of auroras. — Professor Sophus Tromholt has discussed the observations of auroras made by Prof. S. Kleinschmidt at Gotthaab, in Greenland, from 1865 to 1880, together with other observations in northern latitudes, and finds that for polar regions the maximum of auroras corresponds with the minimum sun-spot period, the reverse of what has been noted in temperate zones. The yearly maximum is at the winter solstice, while, in lower latitudes, maxima occur at the equinoxes. Weyprecht has shown that the yearly maximum is due to an oscillation of the auroral zone toward the south at the equinoxes, and toward the north at the solstices. The same explanation is given of the eleven-year period, corresponding with the sun-spot period. Prof. Lemström's production of an artificial aurora is mentioned. — (*Observ.*, April, 1883.) M. McN. [920

Report of work of the Royal observatory, Cape of Good Hope. — In the report for 1882, Dr. Gill states that the observations for the difference of longitude between the observatory and Aden are completed. The great comet was observed on every clear night from Sept. 7, and photographs were obtained on six nights. The heliometer measures for the parallax of certain southern stars are nearly concluded. In connection with observations in the northern hemisphere, *Victoria* and *Sappho* have been observed for determining the solar parallax by Galle's method. Time of contact at the transit of Venus was noted by six observers, and heliometer measures were made during the transit. — (*Monthly not.*, March, 1883.) M. McN. [921

MATHEMATICS.

Infinitesimals. — Mr. M. H. Doolittle looks on infinitesimals, differentials, and zero as having the same denotation, but different connotations. He proposes, in cases where the value of a function becomes indeterminate, to call that value which is continuous with those for preceding and succeeding values of the variable the *serial* value. The differential coefficent, in this view, is the serial value of the ratio of two increments when those increments become zero. — (*Phil. soc. Wash., math. sect.; meeting* May 9.) [922

PHYSICS.

Electricity.

On secondary batteries. — Professor Barker gives a brief history of secondary batteries from the discovery of electrolytic polarization by Gautherot, in 1801, to the invention of the Faure cell, together with the results of his own experiments upon cells of this latest form.

In charging his series of thirty-four cells by means of a Gramme machine, he used, in order to prevent discharge by a current backward through the machine when the electro-motive force of the latter fell, a 'cut-out,' in which an electro-magnet, through which the current flows, forces the end of a metal bar against a spring, pressing it down, and thus keeping the circuit closed while the current flows in the desired direction. When the current begins to fail, the reaction of the spring opens the circuit.

Using this cut-out, Prof. Barker found that the secondary battery could be employed with great advantage in steadying the current furnished to a series of Edison lamps by a Gramme machine driven by a gas-engine. For this purpose he connected the Gramme and the battery as if for charging, the cut-out being in the circuit, and connected, also, the poles of the battery with the lamps. The electro-motive force of the machine was made very nearly equal to that of the battery, so that, just after each explosion in the gas-engine, the machine prevailing sent a current through the lamps, and also a small current through the battery, slightly charging it; but, before the next explosion occurred, the electro-motive force of the machine had fallen to such a point that the battery now sent a current to the lamps. It is stated, that, although the engine gave only one explosion in four strokes, the pulsations in the light entirely disappeared when the above arrangement was adopted.

Prof. Barker states that his experiments entirely confirm those of Gladstone and Tribe as to the formation of lead sulphate when a secondary cell remains in open circuit. In several cases the acid of the cells disappeared entirely in this way, and lead sulphate formed the entire coating on both plates. On attempting to re-charge such a cell, the resistance was found to be very high, and torrents of gas were evolved from both plates. After a time the resistance fell to its normal value, and the waste of gases ceased, though not till a considerable quantity of energy had been lost.

It appears, moreover, that in the cells employed, although they were intended to be all of like dimensions and construction, there was great difference of storing-capacity and of resistance. After an hour's use on the lamp-circuit, different cells gave on a tangent galvanometer deflections varying from 87° to 0°. When the discharge was continued for a long time, so as nearly to exhaust the battery, it was found that many of the cells were reversed, so as to be now opposing the action of the others. "In place of continuing uniform as a single cell, the electro-motive force of a series of cells begins to fall when about half the charge which it ought to be capable of yielding has been drawn from it." In the Planté cell the local action is far less than in the Faure, the lead peroxide in the former being very much harder, so that not a trace of the sulphate was found in such a cell after six months of frequent use. Prof. Barker appears, therefore, to consider the Planté cell more promising than the Faure, in spite of the much greater time required to form it. — (*Proc. Amer. assoc.; Montreal meeting*, 1882.) E. H. H. [923

CHEMISTRY.

(*General, physical, and inorganic.*)

Ammonio-argentic iodide. — By digesting argentic iodide with a solution of ammonia, A. Lougi obtained the compound NH_3AgI. — (*Gaz. chim. ital.*, 1883, 86.) C. F. M. [924

Bleaching-powder and analogous bodies. — The constitution of this substance is again reviewed by Lunge and Naef. In 1882 Kraut objected to the formula, Cl — Ca — O — Cl, first proposed by Odling for the dry salt, and apparently confirmed, in 1880, by Lunge and Schaeppi. Kraut's objections were twofold. In the first place, he asserted that all the chlorine in bleaching-powder was expelled by a mixture of carbonic dioxide and hypochlorous acid, and, secondly, that bleaching-powder was analogous to the lithium salt ($LiCl + LiOCl$). In answering the first objection, Lunge and Naef affirm that Kraut must have started with a basic calcic chloride, which, with hypochlorous acid, gave, first, bleaching-powder, from which carbonic dioxide set free the chlorine, —

$$Ca{}^{Cl}_{OH} + HOCl = H_2O + Ca{}^{Cl}_{OCl} . - Ca{}^{Cl}_{OCl} + CO_2 = CaCO_3 + 2Cl.$$

They further assert that $CaCl_2$ may be decomposed by hypochlorous acid ($CaCl_2 + Cl_2O = CaOCl_2 + Cl_2$). Concerning the second point urged by Kraut, Lunge and Naef find that eighty-eight per cent of lithic hydrate is converted into the basic chloride, while, according to Kraut, fifty per cent only should enter into the reaction, if it is analogous to bleaching-powder. Chlorine is not eliminated from the lithium salt by carbonic dioxide at ordinary temperatures. At higher temperatures the chlorate is formed, and oxygen evolved. The strontium salt corresponding to bleaching-powder, when treated with carbonic dioxide, behaves in a manner strictly analogous to the calcium salt. The authors regard these facts as sufficient to establish the formula, Cl — Ca — O — Cl. — (*Berichte deutsch. chem. gesellsch.*, xvi. 84.) C. F. M. [925

Action of certain vegetable acids upon lead and tin. — Mr. F. P. Hall tried the action of acetic, tartaric, and citric acids upon lead, tin, alloys of these metals, and upon cans that had been used to preserve fruit. In a solution of approximately the same strength as common vinegar, these acids exerted a much greater corrosive action upon tin than upon lead, whether acting upon the metals separately or in the form of alloys. Both metals were dissolved freely, especially from the cans. The lead probably came from the solder, since it was not detected in the tin of which the cans were made. In the composition of tin foils, every variation was found between samples that were free from lead and those which contained a very high percentage of this metal. — (*Amer. chem. journ.*, iv. 440.) C. F. M. [926

(*Analytical.*)

Direct estimation of chlorine in presence of bromine or iodine, and of bromine in presence of iodine. — According to the observations of G. Vortmann, metallic chlorides are not affected when boiled with the peroxide of lead or of manganese and dilute acetic acid, and only with difficulty by the concentrated acid. Bromides are decomposed by plumbic, but not by manganic peroxide, while iodides are readily decomposed by either. To determine chlorine in presence of bromine, the latter may be expelled by evaporating the solution to dryness with plumbic peroxide and dilute acetic acid. Iodine may be expelled from a mixture of a chloride and an iodide by either plumbic or manganic peroxide and acetic acid. Manganic peroxide is also used to decompose an

iodide in presence of a bromide. In a mixture of the three haloid salts, both bromine and iodine may be removed by plumbic peroxide; or first the iodine by manganic peroxide, and then the bromine by plumbic peroxide. These methods fail to give accurate results when the relative percentage of chlorine is small. — (*Sitzungsber. kais. akad. Wien*, lxxxvi. 244.) C. F. M. [927

AGRICULTURE.

By-products from rice. — The chief by-products of the preparation of rice for market are 'douse,' or bran, 'rice-flour,' and 'polish.' The bran consists of the hull, or pericarp, with a portion of the outer proteine-bearing layer of the true seed adhering to it. The rice-flour is produced by pounding the grain, freed from the hull, in wooden mortars, to complete the removal of the testa and proteine-bearing layer of the seed. It consists of the latter mixed with more or less of the starchy interior portion of the seed. The rice then passes under stiff brushes, which remove the last traces of the outer layer, and more or less starch. The refuse from this process is the rice polish. Analyses of these materials indicate that they are valuable feeding-stuffs, and show them to be decidedly rich in fat and proteine. — (*Rep. N. C. exp. stat.*, 1882, 87.) H. P. A. [928

Analyses of cotton-seed. — The following analyses of the hulls and kernels of cotton-seed were made at the North Carolina agricultural experiment-station.

	Kernels.	Hulls.
Water	6 27	9.16
Ash	4.03	2.28
Proteine (N × 6.25)	29.25	2.19
Crude fibre	4.38	47.12
N. fr. extract	19.52	38.67
Fat	36.55	0.58

The whole seed consists of about equal parts of kernels and hulls. The ash of both hulls and kernels is very rich in potash and phosphoric acid.— (*Rep. N. C. exp. stat.*, 1882, 97.) H. P. A. [929

GEOLOGY.

Lithology.

The Rastenberg granite. — This rock, microscopically studied by Koller, is a porphyritic granite composed of quartz, orthoclase, plagioclase, biotite, and hornblende. These form a medium crystalline mass in which large orthoclase crystals are embedded. Dihexahedral quartz, which is usually present in such rocks, was absent from this. The orthoclase was found to belong to the microperthite variety. While the large crystals were orthoclase, the smaller ones were mostly plagioclase, lying between oligoclase and albite, or, according to Tschermak's theory, between Ab_2An and Ab_1An_3. The absorption and pleochroism of the hornblende were not strong. The colors were, for a, light yellowish-brown; c, clear grass-green; b, dark brownish-yellow; while a < c < b. — (*Min. petrog. mitth.*, v. 215.) M. E. W. [930

The rocks of the Wechsels. — In a paper relating to the lithology of the Wechselgebirge, by Böhm, the rocks are classified as, 1°. Micaceous rocks, divided into albite-gneiss, granulitic-albite-gneiss, mica-schist, epidotic-mica-schist, and quartzite; 2°. Chloritic rocks, into chlorite-gneiss and chlorite-schist; 3°. Hornblendic rocks, into diorite-schist and hornblende-epidote-schist. Descriptions of the microscopic characters are given. Rutile and titanite were found in the rocks, while an observed indistinct striation of the quartz was said to be caused by fluid or glass inclusions. — (*Min. petrog. mitth.*, v. 197.) M. E. W. [931

Rhyolite from Yellowstone Park. — Chemical analyses of two specimens of rhyolite have been made by Mr. W. Beam with the following results: —

Sp.gr.	SiO_2.	Al_2O_3 + Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	(Ignition) H_2O.	Total.
2.40	77.00	13.40	1.25	1.19	3.43	3 62	0.70	100.59
2.60	77.90	14.55	0.40	trace.	2.10	4.63	1.00	100.58

Since but little ferric oxide was obtained, it was estimated with the aluminia. The rock in the first analysis is stated to be a porphyritic obsidian, and, in the second, a quartz trachyte. These names and the analyses indicate that the rocks are rhyolites. — (*Amer. journ. sc.*, xxv. 106.) M. E. W. [932

Meteorites.

The Atacama (Bolivia) meteorite. — This supposed meteorite has been regarded as a pallasite or syssiderite (SCIENCE, p. 41), according as the classification of G. Rose or Daubrée is followed, closely allied to the Siberian form found by Pallas. Dr. S. Meunier dissents from this opinion, although holding that both are specimens of concretionary veins (SCIENCE, p. 18), — a view for which the present writer is unable to see any basis. A chemical and mineralogical examination showed, according to Meunier, that the non-metallic part had the following composition: —

Pyroxene	9.00
Schreibersite	4.00
Chromite	1.20
Anorthite	0 10
Pyrrhotite	0.50
Olivine	85.20
	100.00

— (*Comptes rendus*, xcv. 1384.) M. E. W. [933

The Mocs meteorite. — Professor A. Koch has continued his papers on the fall of meteoric stones in the vicinity of Mocs in the Siebenbürgen, Feb. 3, 1882.

He reports from this fall 912 pieces, weighing collectively 174,113 gr. A chemical analysis, made by his brother, Frank Koch, showed that their average composition was as follows: —

SiO_2	42.74	Mn	0.57
Al_2O_3	trace	Ni	1.38
Fe	7.93	Co	trace
FeO	20.86	S	2.61
CaO	2.78	P	0.41
MgO	15.95	C?	0.19
Na_2O	1.20	Chromite	1.56
K_2O	0.21		
Li_2O	trace		
MnO	1.12	Total	99.51

Koch states that the meteorite fragments are composed of nickeliferous iron, magnetic pyrites, taenite, and silicates. The chemical analysis indicates that they belong to the peridotites. — (*Min. petrog. mitth.*, v. 234.) M. E. W. [934

MINERALOGY.

Löllingite. — Mr. W. F. Hillebrand described an interesting variety of this mineral, recently found on Teocali Creek, Gunnison County, Col. It occurs in aggregates of spheroidal bodies, showing radiate structure when broken, in a gangue of calcite or ba-

rite, and associated with proustite, argentite, native silver, and other minerals. — (*Col. scient. soc.; meeting* April 2.) [935

PHYSICAL GEOGRAPHY.

Ocean currents south of Africa. — On the charts published by the London meteorological office (1882) the following currents are shown at the meeting of the Antarctic, Atlantic, and Indian oceans: first, the Agulhas current, moving south-west along the eastern coast of Africa, with a velocity of 51 knots a day in summer (December to February), 46 in winter, and a maximum of 108. It is 4–5° C. warmer than neighboring water of the same latitude, and in summer carries a temperature of 25° C. to lat. 35°, and 21° to lat. 39°. As the water in Table Bay is much colder, it would seem that this current does not enter the Atlantic, except temporarily, in summer time, but, on meeting the Antarctic current about lat. 40°, long. 23° E., is turned back to the Indian Ocean in a north-easterly direction. That this is not a simple continuation of the Antarctic current is shown by its warmth, as well as by the rapid changes of temperature and the alternation of warm and cold bands about lat. 40°. Second, the Antarctic current south of lat. 40°, moving north-east or north-north-east. This is rather independent of the prevailing winds, which follow the parallels closely. As its strength and northward deflection are greatest, and its temperature and density are least, in summer, it is thought to be strongly influenced by the melting of Antarctic ice. West of long. 20° it gives off branches that flow north, along the west coast of Africa. — (*Ann. der hydrogr.*, 1883, 1, 63.)

At least the occasional passage of the Agulhas current into the Atlantic is shown by the drifting of a bottle thrown overboard off the coast of Natal (lat. 29° 24′ S., long. 33° E.) Dec. 7, 1880, and found on the coast of Brazil (lat. 17° 30′ S.) Aug. 11, 1882. The distance traversed was probably 4,500 nautical miles, or an average of over seven miles a day. — (*Id.*, 61.) W. M. D. [936

Earthquakes on the Armenian plateau. — H. Abich adds a chapter on earthquakes to his geological description of this region, which contains much of importance concerning the volcanoes and other physical features of Armenia, with fine illustrations in maps and views. The two chief seismic centres are the Ararat volcanic group and the Palandokän near Erzerum. At the former, in 1840, a great landslide was produced by a shock, of which Abich's previous description (*Verh. gesell. f. erdk. Berlin*, iv. 1845, 28) is here reprinted. At the latter, on May 21, 1859, strong vertical and horizontal oscillations were felt; and, in a few minutes after the first disturbance, over a third of the town's eight thousand houses were in ruins, and five hundred people were killed or mortally wounded. It was noticed that heavily-built houses suffered more than lighter ones, and that the destruction was much greater in the central, higher part of the city, which stood upon a rocky basis, than in the lower suburbs on the alluvial plain. The earthquake of Shemaka, May 31, 1859, is described in detail, and the general relation of the Armenian with the Mediterranean vulcano-seismic disturbances along the belt between latitude 37° and 40°, from the Caspian to the Atlantic, is discussed. An extended list, compiled from old Armenian chronicles, is added, showing fifty-two earthquakes from 350 to 1650 A.D., in many of which the destruction was very great. — (*Geol. forsch. kaukas. ländern.* ii., *geol. armen. hochlandes, westhälfte. Vienna*, 1882.) W. M. D. [937

The north German plain. — From the Straits of Dover eastward, between the flanks of the Eifel, Harz-, Erz-, and Riesengebirge on the south, and the shore of the North Sea and the Baltic on the north, the country is low and generally flat. Westward from the Elbe, the plain is hardly more than 20 met. above sea-level, except on the Luneberg heath, which rises to 80 met. Eastward from the Elbe, the highest ground is found in lake-plateaus (*seenplatte*) of Mecklenburg (about 100 met.), Pommerania (100), and Prussia (110), with plains of much less elevation and more level surface, both north and south. The gradual rise from the sea is also shown by the low levels of the Rhine (36 met.) at Cologne, 130 miles from the coast; the Weser (40 met.) at Minden, 100 miles inland; the Elbe (45 met.) at Magdeburg, 150 miles; the Oder (20 met.) at Frankfurt, 125 miles; and the Weichsel (41 met.) at Thorn, 110 miles. This flat surface does not end at the shore, but continues under the Baltic and the North Sea. In addition to the stratified sands and clays which cover a great part of this plain, it contains many large erratic bowlders and unstratified deposits, which have heretofore been generally considered the results of a great flood, or of iceberg transport; but recently these deposits have been closely examined, and within the past five years a large number of German geologists have found reason to believe that their low northern country was invaded in post-tertiary time by an ice-sheet extending outward from Scandinavia. Bernhardi (1832) was the first to make such a supposition, but looked to the polar regions for the source of the ice. After him came Agassiz and Naumann (1844); but their observations were overlooked, until, in late years, Berendt, Credner, Helland, Penck, and others, all denied the importation of erratics by floods or by icebergs, and contended for the action of land-ice. Their results are summarized by Th. H. Schunke, briefly as follows: the unconsolidated deposits of north Germany consist, in part, of stratified sands and clays, with land, fresh and marine fossils, for which no explanation has been generally accepted, except that it was accumulated under water; and, in part, of compact, unstratified sheets of drift containing numerous subangular stones, 90 % of which are foreign (from Scandinavia, etc.), 80 % are scratched, and many are of great size. Stones of local origin are carried against the present direction of river-flow, and sometimes to a higher level than their source. Several of the few rock ledges appearing through this drift-covering have been found rounded and striated; and the clayey strata that often underlie the unstratified drift are discovered greatly disturbed, compressed and folded. Pot-holes are very common. All this is best explained by glacial action, perhaps alternating with open water and floating ice. No terminal deposits are yet found, clearly marking the farthest advance of the ice; but the lake-plateaus, a little way inland from the Baltic coast, have all the characteristics of terminal moraines. Elsewhere the surface is lower and more even, being generally levelled off with a sheet of stratified sand, or covered with still more recent moors. The rivers are moderately depressed below the general surface. It has been suggested that the Weichsel and Oder were displaced from their lower courses when the ice-sheet reached the '*seenplatte*,' and then turned westward, near Bromberg and Frankfurt, to join the Elbe above Wittenberg, their old east-to-west channel being much larger than the streams which now occupy it. Although the action of land-ice is thus generally admitted, many questions are by no means settled; notably, the character of the water-basins in which

the stratified deposits were laid down, and the double or treble alternation of these with sheets of unstratified drift. — (*Kettler's zeitschr. wiss. geogr.*, iii. 1882, 101, 138.) W. M. D. [938

BOTANY.

(*Physiological.*)

Formation of cystoliths. — These concretions are very abundant in the tissues of many families of plants; notably, the nettles, hops, and elms. Chareyre traces what he considers a plain connection between these epidermal concretions in this group and the hairs over them. In some cases the calcification begins high up in the hair, and, having proceeded as far as its base, gives rise to a concretion at the surface of the leaf, but in most cases goes on to form a calcareous mass below this. This subepidermal concretion is the cystolith. It is an interesting fact that similar concretions should occur in perfectly smooth leaves of closely allied plants. Did these once possess hairs of like character? — (*Comptes rendus*, April 9.) G. L. G. [939

Rate of growth of desert-plants. — Capus has added some interesting facts to our knowledge of the vast influence of plenty of water upon growth. In the botanic garden at Samarcande, Turkestan, he found that Ailanthus glandulosus grew, during the first year, .21 of a metre; it grew .33 in the second, and .89 in the third, — all of which were years in which no irrigation-water was furnished. In the fourth year, *with* water, the growth was 10 metres. He thinks that this tree, together with Gleditschia triacanthos and Robinia, is particularly adapted to desert-culture on account of its possessing tissues in which water is easily retained; but he gives no anatomical details to support his view. — (*Comptes rendus*, April 16.) G. L. G. [940

(*Systematic.*)

The Pomaceae. — Wenzig of Berlin gives a conspectus of the genera and species of this group as defined by him, — an abstract of his previous papers in *Linnaea* and elsewhere. According to his views, our species of Pirus appear under Malus and Sorbus, while Crataegus is merged in Mespilus. Crataegus spathulata, C. aestivalis, and C. arborescens, however, are referred to Cotoneaster; and for C. cordata he forms the genus Phalacros. He admits four American species of Amelanchier. — (*Jahrb. bot. gart. Berlin*, 1883.) S. W. [941

The Turneracae. — A very complete monograph of this order has been made by Urban of Berlin. Bentham and Hooker recognize three genera (Turnera, Erblichia, and Wormskioldia), which are all united by Baillon under Turnera. Urban defines five genera, restoring Piriqueta (of which Erblichia is made a section) and Streptopetalum, and adopting Balfour's recent genus, Mathurina. Piriqueta is characterized mainly by the presence of a corona upon the throat of the calyx, — an organ not previously observed, and important as confirming the close relationship of the order to the Passifloraceae. Eighty-three species are described, mostly belonging to Turnera and Piriqueta and to the warmer regions of America, from Carolina and Mexico to the La Plata, but chiefly Brazilian. The other small genera are confined to Africa; the monotypic Mathurina, to Rodriguez Island. The single species found within the United States, but occurring, also, in the West Indies and Brazil, is referred to Piriqueta (P. Caroliniana, Urban). In Mexico are found one species of Piriqueta and three of Turnera, the 'Damiana' (T. aphrodisiaca, Ward) being made a variety of the widely distributed T. diffusa of Willdenow. — (*Jahrb. bot. gart. Berlin*, 1883.) S. W. [942

ZOÖLOGY.

Tentacles of the Physalia. — Commodore Phelps, U.S.N., is contributing a series of articles under the title 'Reminiscences of the old navy,' one of which contains a notice of a Portuguese man-of-war captured in the harbor of Porto Grande, St. Vincent's Island, Cape de Verdes, whose tentacle was a hundred and seventy-five feet long. Notes are also given on the steamer-duck, the enormous spider-crabs of the Straits of Magellan, and on the life of the albatross. A fine large specimen of the latter was caught off the La Plata River in 1844, and marked. It was again caught in 1868. — (*United serv. rev.*, March.) C. E. M. [943

Protozoa.

Parasitic monads in the blood of fishes. — Mitrophanow has found two species, which he describes as new flagellate monads. They were obtained — one from Cobitis fossilis, the other from Barassius vulgaris — by letting the animal's blood flow into a half-per-cent salt solution. The parasite of the first-named fish occurs in several varieties, and is named Haematomonas cobitis. It is worm-shaped, pointed at both ends, has a flagellum on the front end, and an undulatory membrane on the side. It is 30 to 40 μ long, and 1 to $1\frac{1}{2}$ μ thick, and is very active in its movements. The second species is named H. carassii, and differs from the first by its greater length and more developed membrane.

In connection with this subject, the author criticises Gaule's views regarding the cytozoa observed in the frog's blood, and expresses his agreement with Lankester's description of them as parasites, given in the *Quart. journ. microsc. sc.*, Jan., 1882. — (*Biol. centralbl.*, iii. 35.) C. S. M. [944

A social Heliozoon. — Dr. Joseph Leidy exhibited drawings, and described a singular Heliozoon recently sent to him from Lake Hopatcong, New Jersey. It occurs mostly in groups composed of numerous individuals, one of the bunches, of an irregular cylindroid shape, containing upwards of a hundred. They reminded one of a mass of tangled burrs. They remained nearly stationary even for twenty-four hours, and exhibited so little activity, that, without careful scrutiny, they might readily be taken for some inanimate structure. The individuals composing the groups appeared to be connected by mutual attachment of their innumerable rays, and none were observed to be associated by cords of protoplasm extending between the bodies of the animals, as seen in Raphidiophrys elegans. Some of the individuals were in an encysted, quiescent condition. The active specimens resembled the common sun-animalcule, and measured from 0.024 to 0.036 mm. in diameter. They were observed to feed on two species of Actinophrys. After some hours a few individuals appeared to have separated from the surface of one of the groups, but they were as stationary and sluggish as when in association with the others. — (*Acad. nat. sc. Philad.; meeting* April 24.) [945

Mollusks.

Italian Limaces. — These form the subject of a monograph by Lessona and Pollonera. The authors find nine Arionidae and twenty-nine Limacidae existing in Italy which have hitherto been much confused in publications on the subject. Of the thirty-eight species, twenty-two properly belong to Italy, which possesses thirteen of the others in common with the continent of Europe. One is common to all the

shores of the Mediterranean, and two are cosmopolitan. The dentition and anatomy form the subject of two chapters, and are well illustrated. — (*Mem. acad. sc. Torino*, ii. xxxv.) W. H. D. [946

Molluscan fauna of Sardinia. — The land and fresh-water shells collected by Caroti and others on the island of Sardinia are treated of by the Marquise Paulucci in a separately reprinted paper. The island possesses thirty-one peculiar species, and one hundred others, which are also found elsewhere. The work, which is of a systematic and faunal character, is believed to be very complete, and extends to 247 pages and 9 plates. — (*Bull. soc. mal. ital.*, 1883.) W. H. D. [947

East-Indian Pulmonata. — Godwin-Austen, some time since, published an article in explanation of a plate prepared from drawings by the lamented Stoliczka, of rare and curious land-mollusks, which the latter had observed in a living state during his explorations. In this way some valuable data were made available for students. He has now contributed another similar paper and plate in which species of Oxytes, Rotula, Macrochlamys, Euplecta, and Rhyssota, are represented. In the same publication, Möllendorf contributes several articles on Clausilia of eastern Asia, the Nicobars and Japan. — (*Journ. Asiatic soc. Bengal*, March, 1883.) W. H. D. [948

Crustaceans.

New species and variability of fresh-water Copepoda and Cladocera. — Under the deceptive title of 'Heterogenetic development in Diaptomus,' C. L. Herrick describes some varietal forms of species of Diaptomus, describes a new species of Epischura, and discusses the homologies of the limbs in the genus; remarks upon entozoic parasites of Entomostraca, mentioning the occurrence of such parasites in Cyclops and Daphnia; and describes new species of Cyclops, Daphnia, Scapholeberis, Simocephalus, and Ceriodaphnia, and some post-embryonal stages of Daphnia. The paper is illustrated by three plates. — (*Amer. nat.*, April, May, 1883.) S. I. S. [949

Crustacea in the Leyden museum. — Dr. J. G. DeMan, in No. 3 of his Carcinological studies, gives notes on a number of species of Portunidae and Ocypodoidea, most of them from the East Indies and the west coast of Africa, and describes a new Geothelphusa from Java, and two new species of Sesarma from the west coast of Africa. He adds Plagusia depressa to the small but increasing number of species of world-wide range, extending its habitat from the West-Indian region to the west coast of Africa and Amboina. — (*Notes Leyden mus.*, v. 150.) S. I. S. [950

Arachnids.

Polymorphism and parthenogenesis of acarids. — In an article on the gamasids, Berlese begins with a *résumé* of the anatomy of the group, and then reports his observations on the development of these animals. In this family nearly one hundred species have been described, but many of them are only polymorphic forms. An adult form may be reached through two series of metamorphoses. One is short, comprising only the larva, nymph and adult: it may be called the 'normal' series. In the long or 'abnormal' series the number of forms is greater, because a variable number of generations may intervene. Thus, to give an example, Gamasus tardus produces a larva whch changes into a nymph, and the nymph into the adult tardus. Now, G. stercorarius also produces similar young stages; but the adult stercorarius may change into a nymph, and that nymph becomes a tardus. The nymphs cannot reproduce. Moreover, stercorarius may be produced either directly, or by metamorphosis of another apparently adult form. The order of change cannot be reversed. Except in the final form, parthenogenetic reproduction seems to be common; and perhaps the impregnated eggs alone and always produce males. No morphological character has been detected by which the final forms may be distinguished from the reproducing-nymphs. For this reason no new species of this family can be described until the metamorphoses have been completely worked out.

Berlese has worked out three species, — Gamasus tardus, stabularis, and coleoptratorum. In each there are three different nymphs, each of which has its two sexual forms, besides which are the larva and the two sexual adults, making twelve forms in all. Finally there may be other intermediate varieties.

Berlese has also observed a true paedogenesis, in that the nymphs of Tachynotus inermis in one developmental series change directly into the adult, but, in the second, produce an egg, although they have no sexual orifice. — (*Arch. ital. biol.*, ii. 108; *Bull. soc. ent. ital.*, xiv. 88.) C. S. M. [951

Insects.

The Lucanidae of the United States. — Fuchs issues in a separate form, with a plate, his synopsis of this group, which the Brooklyn entomological society has been publishing by instalments in its bulletin. Enlarged figures are given of the antennae of each of the fourteen species. [952

The European Lixidi. — The biology, and particularly the food-plants, of the insects of this group in its various stages, are given in a tabulated form by Bargagli. Their food is shown to be largely composed of thistles. — (*Bull. soc. ent. ital.*, xiv. 312.) [953

Thorax of Diptera and Hymenoptera. — Brauer compares the thorax of Diptera and Hymenoptera, and concludes that no part of the first abdominal ring ever enters into the formation of the thorax of the former. Latreille's 'segment médiaire' is to be met with only in Hymenoptera. Hammond's view, that the metanotum disappears in the imago of Diptera, is found untenable; and the thorax is composed exactly as in Lepidoptera and Cicada. The thoracic stigmata belong to the meso- and metathoracic rings. Unfortunately the three accompanying plates are very obscurely drawn. — (*Sitzb. akad. wissensch. Wien*, lxxxv.) E. B. [954

Color-preferences of insects. — Bennett and Christy have added a considerable number of careful observations to those already recorded, on the habits of insects when visiting flowers, which show, that, as a general thing, butterflies do not confine themselves to a single species in many successive visits; while flies are more constant, and bees, especially Apis, are markedly so. Lepidoptera seem most fond of red or pink, and of other colors in the following order: yellow, blue, and white. The preferences of Diptera are white, red or pink, yellow; and, of Hymenoptera, generally red or pink, blue, white, yellow. Bombus selects colors in the order, red, blue, white, yellow. — (*Nature*, March 29.) W. T. [955

VERTEBRATES.

Histogenesis of nerve-fibres. — His has studied this subject on human embryos. In one only, 2.15 mm. long, it was found that the nucleated bodies of the cells of the medullary plate were already more

crowded towards the central canal, early marking the central position of the ganglion-cells. The cells send out processes, most of which extend radially: hence the majority of the cells, but not all, are bipolar. Perhaps the irregular outrunners are amoeboid processes. There is at this stage nothing which can properly be called nerve-fibres. In an embryo of five millimetres length, the number of cells in the spinal cord is greatly increased. They lie closer together, thickest centrally; and their nuclei, except in the peripheral portion, have for the most part their long axes running radially. Throughout the cord there is a system of radial fibres, many of which may be seen to be prolongations of the cells. The fibres form a more or less well-marked external layer around the cord; their external ends generally present a trumpet-like enlargement. The roots of the nerves are formed by the outgrowth of these fibres. The motor roots are first developed. They appear first as processes of the ventral cells of the cord, penetrate the limiting membranes, and so enter the body-wall. The posterior roots arise later. His believes that the cells which Balfour, Sedgwick, and others have described as forming the beginning of the roots are merely those which grow out to become the ganglion-cells distributed in the course of the nerves. — (*Arch. anat. physiol., anat. abth.*, 1883, 163.) C. S. M. [956

Reptiles.

Characters of the Hadrosauridae. — Professor Edward D. Cope, after giving a sketch of the classification of the Dinosauria, described in detail the characters of Hadrosaurus and the allied genus Diclonius. The species of the latter, upon which his observations were made, is the Diclonius mirabilis of Leidy, which is represented in Prof. Cope's collection by a nearly complete skeleton, including the skull from the Laramie beds of Dakota. In life, this species presented the kangaroo-like proportions ascribed by Leidy to Hadrosaurus Foulkii. The anterior limbs are small, and were doubtless occasionally used for support, and rarely for prehension. This is to be supposed from the fact that the ungual phalanges are here hoof-like, and not claw-like, though far less ungulate in their character than those of the posterior foot. The inferior presentation of the occipital condyle shows that the head was borne on the summit of a vertical neck, and at right angles to it, in the manner of a bird. The head would be poised at right angles to the neck when the animal rested on the anterior feet by the aid of a V-like flexure of the cervical vertebrae. The general appearance of the head must have been much like that of a bird.

The nature of the beak, and the dentition, indicate for this strange animal a diet of soft vegetable matter. It could not have eaten the branches of trees, since any pressure sufficient for their comminution would have thrown the slightly attached teeth of the lower jaw out of place, and have scattered them on the floor of the mouth. It is difficult to understand, also, how such a weak spatulate beak as these animals possessed could have collected or have broken off boughs of trees. By the aid of its dentate, horny edge, it may have scraped leaves from the ends of branches; but the appearances indicate softer and less tenacious food. Could we suppose that the waters of the great Laramie lakes had supplied abundant aquatic plants without woody tissue, we should have the conditions appropriate to this curious structure. Nymphaea, Nuphar, Potamogeton, Anacharis, Myriophyllum, and similar growths, could have been easily gathered by the double spoon-like bill, and have been tossed by bird-like jerks of the head and neck back to the mill of small and delicate teeth. In order to submit the food to the action of these vertical shears, the jaws must have been opened widely enough to permit their edges to clear each other, and a good deal of wide gaping must therefore have accompanied the act of mastication. This would be easy, as the mouth opens, as in reptiles and birds generally, to a point behind the line of the position of the eye, which was evidently of large size. On the other hand, the indications are, that the external ear was of very small size. There is a large tract which might have been devoted to the sense of smell; but whether it was so or not is not easily ascertained.

We can suppose that the huge hind-legs of Diclonius and Hadrosaurus were especially useful in wading through the water that produced their food. When the bottom was not too soft, they could wade in to a depth of ten or more feet, and, if necessary, drag aquatic plants from their hold below. Fishes might have been available as food, when not too large, and not covered with bony scales. Most of the fishes of the Laramie period are, however, of this kind. The occurrence of several beds of lignite in the formation shows that vegetation was abundant. — (*Acad. nat. sc. Philad.; meeting* April 24.) [957

Mammals.

New character for the Arctoidea. — As further defining the Arctoidea, Flower's third group of the land carnivora, Mr. Jacob Wortman described a peculiarity of the tarsus of these animals, in which the astragalus articulates with the cuboid and the navicular. The character was constant throughout the group, and, he believed, had not before been indicated. — (*Acad. nat. sc. Philad.; meeting* April 24.) [958

ANTHROPOLOGY.

The Foulbes, Peuls, or Fellata. — The nomenclature of ethnology will have to be reduced to some system in a not very distant future. The Bureau of ethnology has endeavored to obtain a complete synonymy of the North American Indian tribes. The work has involved the time and talents of several specialists, and includes several thousands of titles. The names applied to tribes of men, to begin with, have in the hands of authors not always the same inclusion. These names are spelled variously by writers in the same tongue, and with greater variety by those of different tongue. Further, names are often given by the tribe themselves, meaning simply men, location, gens, or parentage; or by their neighbors, meaning all these in each language of tribes in contact; or also including terms of contempt. The reader, therefore, is not astonished to find Ful, Pul, Fulbe, Pouls, Peuls, Foulis, Folos, Foulbes, Fellata, Féllani, Fulan, Futa, etc., applied to those people in western and middle Soudan sprung from negro stock, on which have been ingrafted Arabic blood and religion. Herr Gottlob A. Krause has added somewhat to our knowledge of this people, and especially to their synonymy. They are called Fulan, Felata, by the Arabs; Jfullan, by the Tuaregs; Fillani, Fullani, by the Haussas; Maplatakai, by the Musgus; Felata, by the Kanuri of Bornu; Fulas, by the Mandinkas; Agoi, by the Dschumus of Joruba; Tschilmigo, by the Mossi; Kambumana, by the Gureshas; Folani, Fulga, by the Gurmas; Bale, by the Mfutas and Basutos; Fato, by the Hams; Abate, by the Shukus; and Goi, by the Rupes or Tapas. — (*Das Ausland*, March 3, 1883.) J. W. P. [959

Dialects of Bolivian Indians. — In the northwestern part of Bolivia, along the rivers Beni, Mamore, and Yacuma, live the Cayuába, Mobima, Canichána, and Trinitaria Indians, who have come under

the influence of civilization. On the east side of the Mamore, from Exaltacion as far north as the mouth of the River Guapore, or Itenez, are the wild Houbarayos, and opposite them the Chacobos. The Cangaparangas are near the head of steamboat navigation on the Madeira. On the River Beni, between 11° and 12° south, is the small tribe of Pacaváras. Their skin is almost white. The Araunas, who are to be found on the banks of the Madre de Dios, are no doubt cannibals. The civilized Tacanas live in the village of Tumupasa, on the River Beni, and eighteen miles north-west of them, in the village of Ysiamas, the uncivilized members of the same tribe. In the little town of Reyes, opposite to them, on the Beni River, are the Marópas, related to the Tacanas. Forty miles up the Beni is the mission of Muchanes; beyond that, Santa Ana; and, farther on, Covendo; in all of which are the Moseténa Indians. In the description of these tribes, Dr. E. R. Heath gives the Smithsonian vocabulary for the Canichána, Cayuába, Mobíma, Marópa, Moseténa, Pacavára, and Tacana. — (*Kansas city rev.*, April.) J. W. P. [960

(*Folk-lore.*)

Folk-lore in Europe. — A noteworthy activity in the field of folk-lore is shown throughout Europe at present. The annual proceedings of the Portuguese folk-lore society have been recently issued at Oporto, edited by De Vasconcellos, author of *Tradicoes populares de Portugal*, and of a considerable number of folk-tales published within recent years.

Italy has done much for folk-lore since 1869, having furnished nearly one thousand folk-tales, and such important works as those of De Gubernatis. Palermo now gives us a folk-lore journal, the *Archivio per lo studio delle tradizioni populari*, edited by L. Pedone-Lauriel.

In France much is done, both in collecting and publishing. Maisonneuve & Co. are issuing a series of works on the folk-lore of all nations. Among the most important that have appeared are Sebillot's *Littérature orale de la Haute-Bretagne; Traditions et superstitions populaires de la Haute-Bretagne;* and Luzel's *Légendes chrétiennes de la Basse-Bretagne.* The same house publishes a folk-lore almanac, the second volume of which has appeared. Besides other interesting matter, this almanac contains the addresses of continental and English folk-lorists, and a carefully compiled folk-lore bibliography of the year.

In Germany and the Slav countries the work of collecting and publishing folk-lore is continually carried on with more or less activity. — J. W. P. [961

The folk-lore society of London. — The *Folk-lore journal*, now in its first year, was established by the Folk-lore society of London to satisfy a want felt for some time. Folk-lore, in the comprehensive sense of the term as now used, is growing in the world's esteem every year, and will continue to grow in proportion as its real scope and value become known. The establishment of this monthly journal was therefore most opportune, and will be welcomed by students of the mental history of mankind. Each number consists of thirty-two pages, octavo, containing generally four articles, and concluding with notes, queries, notices and news, all relating to folk-lore. To this may be added three pages of book advertisements and criticisms printed on the cover. The subjects treated in the first four numbers are: The oratory, songs, legends, and folk-tales of the Malagasy; Babylonian folk-lore; A building superstition; Stories of fairies from Scotland; Folk-tale analysis; Irish folk-tales; Bibliography of folk-lore publications in English; The hare in folk-lore; Anthropology and the Vedas; Index to the folk-lore of Horace; Some marriage customs in Cairnbulg and Inverallochy. — J. W. P. [962

Folk-lore. — The Folk-lore society of London has undertaken an analysis and classification of the folk-tales of all nations. This very important and difficult task has been intrusted to a committee, which has entered upon its labors, aided by several members of the society, who have volunteered their assistance. It is believed that a thorough analysis will reveal the root-stories and their derivatives in the various cycles of folk-tales throughout the world. When these root-stories are discovered, they are to be classified in a satisfactory system, and their derivative stories ranged under them. At a later period, myths, god and hero tales, may be treated in a like manner. A good classification of the folk-tales and myths of mankind would be a monumental work of usefulness. The efforts of the society will be watched with interest. — J. W. P. [963

Brazilian folk-lore. — Though no efforts are made in South America to collect the languages or lore of the aborigines, a volume of Brazilian folk-lore is announced for early publication in Lisbon, under the title of *Contos populares do Brazil*, by Theophile Braga. Though called Brazilian, this collection will, of course, be essentially Portuguese in character.

In the United States we have never made a collection of European-American folk-lore. But trained scholars are now making for the Bureau of ethnology a collection of the folk-lore of the North-American Indians, which, beyond doubt, will be one of the most interesting contributions offered to science for many years. — J. C. [964

Folk-lore dinners. — In 1882 a series of dinners was arranged in Paris to enable folk-lorists to meet in a social and informal manner. During the year four of these symposia were held, presided over by Messrs. Gaston Paris and Loys Bruyère. The same number will be given this year. They are called the dinners of '*Ma Mère l'Oye*' (Mother Goose dinners), and, judging by the accounts, are a decided success. It is suggested to the London society, by one of its members, to follow the example of the French. — J. C. [965

EGYPTOLOGY.

Bibliography. — The intellectual activity engaged, and the progress made, in oriental studies during the year 1882, is strikingly exhibited in the "Bibliotheca orientalis, or a complete list of books, papers, serials, and essays, published in 1882 in England and the colonies, Germany and France, on the history, languages, religions, antiquities, and literature of the east, compiled by Ch. Frederici, Leipzig, London, Paris, New York," 79 p. 8°. The whole number of titles given is 1,284, but, allowing for titles repeated, there still remain between 1,100 and 1,200 publications in 1882 on the east. Of these, 120 were devoted specially to Egypt, and include the weighty names and important works of Leemans, Birch, Brugsch, Chabas, Dümichen, Ebers, Erman, Golenischeff, Lefébure, Lepsius, Mariette, Maspero, Naville, Perrot, Piehl, Pierret, Renouf, Revillout, Schiaparelli, Stern, *et al.* In some schools of Semitic philology it is the fashion to speak contemptuously of Egyptology; but it would not appear to be the part of wisdom to pit pure philology against innumerable stone monuments with legible inscriptions plus a philology represented by an array of scholars the equals in all respects of their detractors. Semitic scholars, with other scholars of antiquity, must accept the well-founded results of cautious study of the monuments of Babylonia and Egypt, or they will find the flood upon them. — H. O. [966

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

A new sperm-whale. — The Smithsonian institution has recently received from Life-saving service No. 84, at Spring Lake, New Jersey, a very valuable specimen of a pygmy sperm-whale of the genus Kogia. This is apparently the first instance of the discovery of a cetacean of this genus in the North Atlantic. Five species have been hitherto described, — three from the Australian waters, one from the Cape of Good Hope, and one from the Gulf of California. The recently acquired specimen differs from Kogia Floweri, apparently the most closely allied species, in having less incurved teeth, longer pectorals, a higher dorsal, and the symphysis of the lower jaw more convex below. It may be denominated Kogia Goodei.

The specimen has been photographed and cast, and the viscera have also been preserved. The animal proved to be with young, the foetus measuring about three feet in length. F. W. TRUE.

Bureau of ethnology.

Prehistoric remains in North Carolina. — Mr. John P. Rogan and Dr. J. Mason Spainhour have made some important finds of antiquities in North Carolina. In one mound they found there had been sixteen persons buried, ten of them in stone graves or cists, not of the usual form, but built up in a conical shape of small stones, arched over, and closed at the top. In nine of these the skeletons were sitting upright. It appears, that before the burial the ground, to the full size of the mound, had been excavated to the depth of about three feet; the bodies were then placed in a sitting-posture, and the stone tombs built over them. At the centre, a small round hole had been dug some three feet deeper, a body had been placed therein in a standing-posture, and the tomb built up around it so as to cover the head; the capstone being a large piece of steatite. Immediately under this, on top of the head, were several plates of cut mica. At one point in this mound was found an oblong structure, 24 inches long, 18 inches wide, and 18 inches high, built up solidly of river-stones. No implements or other articles, except a few broken pipes, were found in this mound.

A short distance north of this was discovered a triangular enclosure filled with graves, some of them incased with stone, others not. In some of these graves there were two skeletons, one placed above the other; the lower one in each case being of small stature, with very heavy flat stones placed on the arms and legs.

In one large grave were found ten skeletons, the principal one with the face downwards. Under his head was a large engraved shell; around his neck, the remains of a necklace of large-sized beads; at each ear, pieces of copper; around each wrist, bracelets composed of copper and shell beads; on his breast, a piece of copper; at his right hand, two implements of hammered iron; under his left hand, an engraved shell filled with beads of various sizes. The other nine skeletons were arranged around this one, extending in all directions; under two of them were also found engraved shells. Scattered over the area were found a number of stone axes, polished celts, descoidal and rubbing stones; a number of steatite pipes highly polished, with bowl and stem of one piece; also copper arrow-heads, plates of mica, graphite, etc.

These articles have all been received by the bureau. The same parties have since opened another mound, in which were found fifty-five skeletons, four or five engraved shells, copper beads, a piece of hammered iron, pots, cups, one tomahawk, a number of stone implements, about a dozen pipes, mica, galena, etc.

Department of agriculture.

Artesian wells. — The work under the department for the sinking of artesian wells in the arid lands of the west, is going steadily on. A recent report from artesian well No. 1, at Akron, Col., gives the following state of affairs, — Feb. 23, a depth of 925 feet had been reached with 1,063 feet of casing in, as follows: 100 feet of 10-inch, 293 feet of 8-inch, and 670 feet of 6-inch. The character of the formations has been, 10 feet clay and gravel, 10 feet gravel, 10 feet of a chalky deposit, 50 feet conglomerate (sand and gravel), 8 feet hard sand rock, 20 feet chalky rock 12 feet gravel and clay, 92 feet dry black clay, 10 feet sandstone, 113 feet blue slaty shale, 570 feet shale. At 50 feet a small amount of water was found, at 100 feet the water rose 15 feet, at 128 feet it rose again slightly, at 355 feet there was a rise of 80 feet, and at 540 feet the water rose again 305 feet.

STATE INSTITUTIONS.

Ohio meteorological bureau, Columbus.

Weather report for March. — The atmospheric pressure was generally less than for any month yet reported by this bureau. The maximum barometric height (30.619 inches), the mean (30.060 inches), and the minimum (29.424 inches), are all less than the corresponding figures for previous months. Both the maximum and minimum are reported from the lake region, the former having been observed at Oberlin, and the latter at Sandusky.

The remarkable feature of the weather for the month was the extremes of temperature that were recorded, and the unusually low mean for the whole month over the whole state. This mean was 32.4°. In a series of temperature observations extending over periods of from six to twelve years, and fairly well distributed over the state, the mean temperature for the month of March is found to be about 38°, so that the past month must be regarded as unusually cold. The extremes of temperature are even more remarkable. A maximum of 75° is reported from Ironton on the 18th, and a minimum of 17.4° below zero at Wauseon on the 20th. This makes a range for the state of 92.4°, which is above any previously reported, and one not likely to be reached again during the year. The fall of temperature about the 18th, 19th, and 20th, was extraordinary. Wauseon reports the maximum daily range, which was 53.2° on the 18th. This station has continuously reported the lowest temperatures. During the past four months the lowest points reached have been as follows: —

	Temperature below zero.
Wauseon, December	16.4°
" January	17.5°
" February	12.0°
" March	17.4°

From this it will be seen that the temperature

reached on March 20 was only one-tenth of a degree higher than the lowest for the season. It is hardly to be expected that Wauseon will continue furnishing such records as this. The mean daily range of temperature over the whole state was 19.2°, which is also unusually great.

The amount of precipitation during the month was less than is usual for March. The mean depth of rain or melted snow was 2.18 inches, while the mean of observations extending over several years is 3.17 inches for the month of March. Rain or snow fell, on an average over the whole state, on twelve days in the month. A thunder-storm of considerable violence, and covering a considerable area, occurred on the evening of the 14th. Westerly winds prevailed.

Missouri weather-service, St. Louis.

Weather report for April. — The average temperature of April has been 56.7° at St. Louis, which is about half a degree above the normal of Engelmann's series. Since 1837 the mean April temperature has once reached 66.8° (in 1844), and in 1857 it fell to 44.1°, a range of 22.7°. The extremes during the last month have been 32.2° (on the 24th) and 85.6° (on the 14th), which are very ordinary temperatures. In April, 1857, the lowest daily minimum was 18°; while in the years 1838, 1843, and 1855, the highest maximum reached was 93°. In the state the maximum temperature has been the highest in the central part, Glasgow reporting 93°, Miami 92°; while at Cairo, Ill., the highest temperature reached was 84.5°, that at Keokuk being 85°. The lowest minimum reported was 22°, at Centreville; and twelve stations out of twenty-one reported the minimum as 32° or below.

The rainfall at the central station has been 2.62 inches, the normal rainfall being 3.70 inches. At the St. Louis water-works, however, the rainfall has been 3.87 inches. The rainfall has been heaviest, or more than 5 inches, in the extreme south-eastern part of the state. In the central-western part, and in a narrow belt extending therefrom to Macon and Shelbina, the fall has been less than 1 inch, while in the north the fall has been over 2 inches. At four P.M. on the 14th a severe local storm, which was apparently an incipient tornado, did considerable damage at Hannibal. Its track was about three hundred feet wide. Similar storms, with hail, were observed seven miles west and ten miles north of Mexico. A small tornado having a width of fifty to seventy feet, passed through the western part of Pleasant Hill between half-past seven and eight A.M. A portion of a rail fence was carried eight feet, and set down without materially changing the relative positions of the rails.

In the dry area of the past month, where ice-crust did damage to the wheat during the winter, additional damage has been done by the drought and high winds of the past month. At Savannah not over one-tenth of a crop is left, and farmers are planting the ground in corn. Meadow is also light. In the south-eastern part, however, the plentiful rains have repaired to some extent the damage done to wheat, and it is turning out better than was expected. Thus far the fruit-crop has not been materially injured by frost, the cool and uniform temperature having been very favorable.

State university of Kansas, Lawrence.

Weather report for April. — During this month the temperature was high, the rainfall was a full two-thirds of the normal quantity, and the cloudiness, wind-velocity, and humidity were each considerably below the averages. The only frost was a harmless hoar-frost on the 24th. All kinds of fruit-trees were in blossom from the 10th to 30th.

Mean temperature, 57.18°, which is 3.17° above the average April temperature of the fifteen preceding years. Highest temperature, 89.5°, on 13th; lowest, 35°, on 24th; monthly range, 54.5°: mean at 7 A.M., 51.02°; at 2 P.M., 67.7°; at 9 P.M., 55°.

Rainfall, 2.12 inches, which is 0.92 inch below the April average. Rain fell on nine days. There was no snow. There were two thunder-showers. The entire rainfall for the four months of 1883 now completed has been 6.44 inches, which is 1.31 inches below the average for the same period in the past fifteen years.

Mean cloudiness, 40.11 % of the sky, the month being 8.80 % clearer than the average. Number of clear days (less than one-third cloudy), 16; entirely clear, 6; half-clear (from one to two thirds cloudy), 9; cloudy (more than two-thirds), 5; entirely cloudy, 2: mean cloudiness at 7 A.M., 45.67 %; at 2 P.M., 43.33 %; at 9 P.M., 31.33 %.

Wind: S.W., 22 times; S.E., 20 times; N.W., 17 times; S., 13 times; E., 3 times; W., 3 times; N.E., 12 times. The entire distance travelled by the wind was 12,936 miles, which is 1,248 miles below the April average. This gives a mean daily velocity of 431 miles, and a mean hourly velocity of 17.96 miles. The highest velocity was 50 miles an hour, on the 14th. Mean velocity at 7 A.M., 15.60 miles; at 2 P.M., 22.40 miles; at 9 P.M., 15 miles.

Mean height of barometer, 28.957 inches; at 7 A.M., 28.969 inches; at 2 P.M., 28.917 inches; at 9 P.M., 28.984 inches; maximum, 29.473 inches, on 24th; minimum, 28.289 inches, on 22d; monthly range, 1.184 inches.

Relative humidity: mean for month, 53.33; at 7 A.M., 64.7; at 2 P.M., 36.7; at 9 P.M., 58.6; greatest, 100, on 5th; least, 10.5, on 17th and 24th. There were two fogs.

NOTES AND NEWS.

The first meeting of the Ohio state forestry association was held in Cincinnati, April 25 and 26. Several papers upon tree-planting and forestry were read; the most elaborate, based upon the preliminary publications of the tenth census, being that of the United States commissioner of agriculture. The meeting, however, if we may judge from the meagre reports published in the Cincinnati papers, produced no new facts about forests or forest management, and quite failed to arouse any local enthusiasm.

It is difficult to decide how far these forestry conventions, of which several have been held during the past year or two in different parts of the country, serve the cause their promoters desire to foster. Forest preservation has become, from various points of view, a question of great national importance for the United States. Economists are properly alarmed at the prospect of a speedy exhaustion of some of our most valuable varieties of lumber, although the more serious dangers which threaten the country through the effects of improper forest destruction upon the flow of rivers and agricultural prosperity have hardly yet received proper attention.

Conventions of self-termed 'friends of the forest' have thus far failed to bring about any reform in the

management of the forests of the country, whether private, or situated on the public domain. But as such meetings serve to keep the general subject before the public, it would not be fair to say that they have not some value. Forest orators at these meetings invariably deplore the want of an American system of forestry, and declare that such a system must be provided at once. We are not sure that we exactly know what they mean by an American system of forestry (it would indeed be an elastic system which would be equally applicable to the forests of Florida and Michigan); but it is safe to predict, that, if our forests are ever managed under any sensible system which will secure the greatest benefit from them for the whole community, such a system will be reached through scientific investigation, quietly pursued along lines of definite research, and not by the teachings of enthusiasts who attend conventions, and find it easy to tell us all about forests, and what they do in Europe to preserve them.

— At the meeting of the Washington anthropological society, held May 1, Mr. Albert S. Gatschet gave an account of his recent journey to the Shetemacha Indians in southern Louisiana, near and on the Gulf coast. Once these people were very powerful in this region ; but they are now reduced to a handful, very much mixed, the younger ones even refusing to learn the mother-tongue. Many of their old practices yet prevail ; but the innovation of new ways and words upon the old gives a most instructive lesson upon the growth of civilization. At the same meeting, Professor Cyrus Thomas made a report upon a map of mound distribution which he is preparing under the direction of the Bureau of ethnology. The plan has been to collect and classify from every available source the mounds enumerated in each state where they exist. From these data the map has resulted.

— The mathematical section of the Washington philosophical society, April 26, heard the conclusion of Mr. Kummell's discussion of alignment curves, and Prof. A. Hall on The determination of the mass of a planet from the relative observation of two satellites. May 9 Mr. M. H. Doolittle read a paper on Infinitesimals and infinites, which gave rise to considerable discussion as to the true meaning of these terms. Mr. E. B. Elliott then explained the construction of perpetual calendars.

— The Philosophical society of Washington, at its meeting, May 5, listened to Mr. H. A. Hazen on Hygrometric observations, and Mr. E. J. Farquhar on Dreams in their psychological relation.

— The Natural history society of Toronto has just elected as office-bearers for the coming year, Dr. Brodie, president; Messrs. Pierce and Seaton, vice-presidents; Mr. Williams, recording secretary; Mr. Clare, corresponding secretary; and Mr. Mosey, curator and librarian. The question of the usefulness of the English sparrow was brought up at the last meeting by Mr. Henry Melville, who urged the society to petition the Canadian government to furnish such material assistance as might enable the society to secure practical results.

— At a meeting of the Department of science and arts of the Ohio mechanics' institute, held May 10, Mr. George W. Bugbee read a paper on the Manufacture of small fire-arms, which was illustrated by models and blackboard drawings; and Dr. F. Roeder exhibited a method of purifying muddy water by means of dyalized iron.

— At the meeting of the Biological society of Washington, May 11, communications were made by Prof. L. F. Ward, on some hitherto undescribed fossil plants from the lower Yellowstone, collected by Dr. C. A. White in 1882; by Mr. Frederick W. True, on a new pygmy sperm-whale from the New Jersey coast; and by Dr. Thomas Taylor, on Actinomykosis, a new infectious disease of man and the lower animals, with exhibition of a portion of the diseased viscera of a dog containing specimens of the fungus Actinomyces.

— The annual report of the North Carolina agricultural experiment station is very largely composed of the results of analyses of commercial fertilizers, and of amateur field-experiments on their use. Some of these have been previously published in the form of bulletins, and have been noticed in our columns. A few fodder-analyses are also given, among them some of the by-products of cotton-seed and rice, an account of which appears in another column; and a field-experiment with cotton is reported, giving the interesting result that too heavy manuring with nitrogen (on poor land) actually decreased the crop of cotton, presumably by unduly stimulating the growth of the vegetative organs.

— A meeting of the United States naval institute was held at Annapolis on May 10, at which the prize essay of '83 was discussed, and Professor Charles E. Munroe read a paper on the Drying of gunpowder magazines.

— Mr. E. W. Nelson, who arrived in Washington last week for the purpose of completing his report upon the ethnology and zoölogy of Alaska, has suffered a decline in health, and will be forced to return to Colorado immediately.

— Dr. Tarleton H. Bean will go to London in June, to be present at the Fisheries exhibition, and to prosecute some important studies in ichthyology in co-operation with Professor Goode. He will probably visit the principal museums on the continent.

— The treasurer of the American committee of the Balfour memorial fund acknowledges the following subscriptions: Dr. S. Weir Mitchell, Philadelphia, \$25; Roswell Fisher, M.A., Cantab, Montreal, \$5; Dr. T. W. Mills, McGill college, Montreal, \$2. Previously acknowledged, \$486.2[illegible].

SCIENCE DIRECTORY

OF

Trustworthy firms dealing in or manufacturing apparatus, books, and other goods required by persons engaged in scientific and literary work.

The publisher has carefully made up this directory, and inserts the name of no firm that he has any reason to believe is not wholly trustworthy in every particular. Any subscriber or reader of "Science" who ever experiences any difficulty with one of these firms will greatly oblige the publisher by notifying him of the fact, so that the firm's name may immediately be taken from this Directory.

It may be taken for granted that any firm herein mentioned will promptly and carefully send all desired information—with catalogue and circulars, whenever issued—to any person who mentions this paper in opening the correspondence.

MOSES KING,
Publisher of "Science,"
Cambridge, Mass.

Albertypes and Lithographing.
FORBES COMPANY, 181 Devonshire St., Boston.

Amateur Photograph Outfits.
BLAIR TOUROGRAPH Co., 471-475 Tremont St., Boston.

Electrical Supplies and Test Instruments.
ELECTRICAL SUPPLY CO., 17 Dey St., New York.

Illustrations and Drawings.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

Photo-Engraving and Designing.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

DAKOTA.
Trustworthy information given, and safe and lucrative investments made, for non-residents in this most prosperous region.
NEW-YORK REFERENCES.—Horace White; George S. Morison. BOSTON REFERENCES.—Tower, Giddings, & Co.; Henry F. Coe. SALEM REFERENCE.—David Pingree.
ALDEN & WATERS, Land Agents, JAMESTOWN, DAKOTA.
John A. Alden. Clifford C. Waters.

A USEFUL BOOK.
For the benefit of ladies who use knitting-silk, the Nonotuck Silk Company have carefully prepared a book entitled "How to use Knitting-Silk." It is full of new engravings, and handsomely printed. Sent on receipt of two three-cent stamps.
GEORGE D. ATKINS, 18 Summer St., Boston.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.
Engraver on Wood. References: American Steam Gauge Co., Boston Journal of Commerce.

IVERS AND POND PIANOS
STANDARD OF EXCELLENCE

Catalogues giving full information furnished upon application.

IVERS AND POND PIANO COMPANY,
597 WASHINGTON STREET, BOSTON.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

Regular four-year courses in Civil, Mechanical, and Mining Engineering, Architecture, Chemistry, Physics, Natural History, etc. Students are also admitted to partial or special courses. School of Mechanic Arts for instruction in English, French, Drawing, Mathematics, and Shopwork. Next school-year begins Sept. 24, 1883. Entrance examinations May 31 and June 1, Sept. 18 and 19, at 9 A.M.
ROBERT H. RICHARDS, Secretary.
FRANCIS A. WALKER, President.

DE VEAUX COLLEGE.
Suspension Bridge, N.Y., prepares for the universities, etc. Terms $350 per annum.
WILFRED H. MUNRO, A.M., President.

MRS. PIATT'S SCHOOL FOR YOUNG Ladies, Utica, N.Y. The next school-year begins Wednesday, Sept. 19, 1883. Applications should be made early.

MISS ANABLE'S BOARDING AND DAY SCHOOL FOR YOUNG LADIES,
1350 PINE STREET, PHILADELPHIA, PENN.
The thirty-fifth year begins Sept. 19, 1883.

THE NATION.

EIGHTEENTH YEAR.
Size recently enlarged to twenty-four pages, and PRICE REDUCED TO $3 PER YEAR.
Sample copies sent on request. Address the
PUBLISHER, 210 BROADWAY, NEW YORK.

THE NEW BOTANY.
A lecture on the best method of teaching the science. By W. J. BEAL, M.Sc., Ph.D., Professor of Botany in Agricultural College, Lansing, Mich. Second edition. 8vo, paper. Mailed, postage free, for 25 cents. Send for circular and book-list free. Address
CHARLES H. MAROT, PUBLISHER,
814 Chestnut Street, Philadelphia.

HENRY C. DIMOND & CO.,
Manufacturers of and dealers in Self-Inking Stamps, Rubber and Metal Stamps of all kinds. Ribbon Stamps, Seal-Presses, Inks, Ribbons, Seals, Dies, etc. Repairing a specialty.
22 Milk Street, Boston, Mass.

QUEEN & CO., PHILADELPHIA,

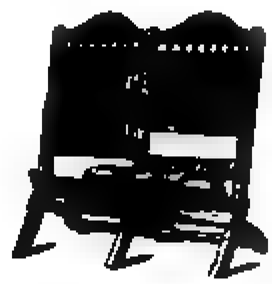
Manufacturers and Importers of Scientific Instruments of every description: Optical, Mathematical, Philosophical, and Chemical.

OUR CATALOGUES

are published in parts, and will be mailed upon application, as follows:—

Part 1, Mathematical Instruments, 162 pages. Part 2, Optical Instruments, including Spectacles, Microscopes, etc. (54th edition, 1883, now ready), 188 pages. Part 2 (Supplement), Opera, Field, and Spy Glasses, 32 pages. Part 2 (Supplement), Second-hand and other Microscopes, 16 pages. Part 3, Magic Lanterns and Slides, 150 pages. Part 3 (Supplement), Apparatus and Diagrams for Luminous Projections, 75 pages. Part 4, Physical Instruments, 188 pages. Part 4 (Supplement), Chemical Apparatus, Balances, etc., 59 pages. Part 4 (Supplement), Second-hand Physical and Chemical Apparatus, 16 pages. Part 5, Meteorological Instruments, Hydrometers, etc., 120 pages.
JAMES W. QUEEN & CO., PHILADELPHIA.

PERFECT SEATING.



The newest and best styles for Recitation-Rooms, Halls, Opera-Houses, Sunday Schools, Lodge-Rooms, Offices, etc.
HARWOOD CHAIR-SEAT CO.,
24 WASHINGTON STREET, BOSTON.
Send for catalogue, and state requirements.

BROWN BROTHERS & CO.,

59 WALL STREET, NEW YORK,

ISSUE COMMERCIAL AND TRAVELLERS' CREDITS

For use in this country and abroad.

SULLIVAN BROTHERS & LIBBIE,

AUCTIONEERS.

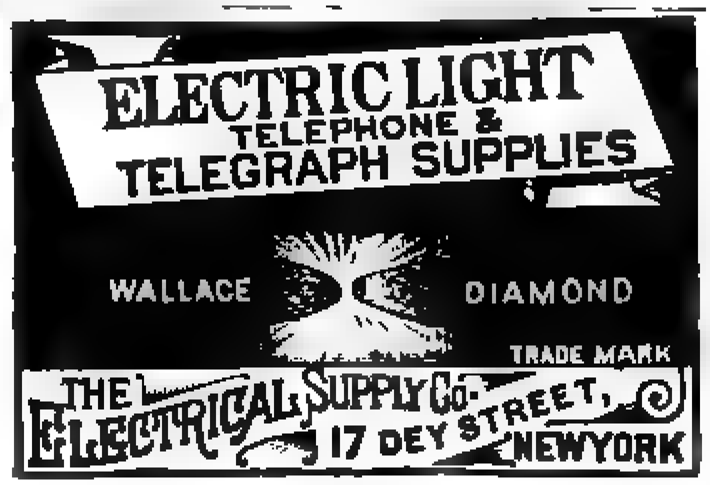
SALESROOM . . . No. 2 BEACON STREET,
BOSTON, MASS.

Special facilities for the display and sale, by auction, of private libraries (large or small), autographs, coins, paintings, engravings, works of art, furniture, fancy goods, etc. Catalogues sent to, and orders executed for, librarians and bookbuyers gratis.

F. W. CHRISTERN, 37 West Twenty-Third Street, New York, Importer of Foreign Books, agent for the leading Paris Publishers, Tauchnitz's, British Authors, Teubners's Greek and Latin Classics. Catalogue of stock mailed on demand. A large assortment always on hand, and new books received from Paris and Leipzig as soon as issued.

STUDENTS' SONGS.

A new collection of songs, as sung by jolly students at all leading colleges throughout this country, has just been published, under the title of "STUDENTS' SONGS," by Moses King, Cambridge, Mass. It contains 64 pages of songs, with full piano accompaniments, and sells at only 50 cents a copy.



SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on Monday. Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies, [illegible] cents. Advertising rates sent on request. Address all correspondence about contents of paper to "EDITOR of SCIENCE, *Cambridge, Mass.*;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

LE LIVRE.

REVUE DU MONDE LITTÉRAIRE.

Archives des Ecrits de ce temps.

CONTENTS OF THE MAY NUMBER.

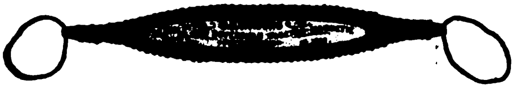
BIBLIOGRAPHIE MODERNE.

I. Bibliographie et Œuvres Perdues d'Alfred de Musset, par Derome.
II. Les Illustrateurs de Livres au XIX^e siècle: Gustave Doré, par E. Forgues.
III. Chronique du Livre: ventes aux enchères, renseignements et miscellanies.

BIBLIOGRAPHIE MODERNE.

Correspondances Étrangères.—Comptes Rendus des Livres Récents.—Gazette Bibliographique.—Sommaire des Publications Périodiques Françaises.

Paris. A. QUANTIN, Publisher. OCTAVE UZANNE, Editor.



WATERS'S FLESH-BRUSH.

The brush is made of vegetable fibre, with a due amount of animal fibre upon one side, making a positive and negative electrical surface, and practically a double instrument. The material is so disposed, that, when in use, a firm looped fibre is brought in contact with the surface to be acted upon, instead of the ends of bristles, as in the old brush, giving it great detergent power. It assists in restoring to and preserving in health by quickening the surface circulation, relieving internal congestions, freeing the pores of the skin, and promoting their functional activity; in that way relieving the blood of much clogging, effete matter that would otherwise oppress the circulation, and might injure the lungs and kidneys in passing from the body, possibly producing Bright's disease or consumption.

It is an admirable substitute for the Turkish bath, giving most of the benefits, with none of the drawbacks, of that luxury.

It also renders the system more sensitive to massage treatment, so that better results are obtained where it is in daily use.

A proper daily use of this brush helps all the organs of the body towards a healthy activity. It will be sent free of expense to any address, *with full directions for use*, worth more to any one than the price of the brush, on receipt of three dollars. Liberal terms will be given to the trade on application to the proprietor.

G. F. WATERS,

8 Beacon Street, Boston, Mass.

THIRTY YEARS' EXPERIENCE.

D. P. ILSLEY & CO.,

THE LEADERS OF FASHIONS IN

LADIES', GENTLEMEN'S, AND CHILDREN'S

HATS AND FURS.

Ilsley & Co. exhibit in the season of 1883 the largest and most valuable stock of Straw Hats ever exhibited in Boston for Ladies, Gentlemen, and Children. These Straw Hats range from the finest to the coarsest, from the lowest to the highest priced. They come from the best makers of Europe and America, and include every leading style of this year.

D. P. ILSLEY & CO.,

381 WASHINGTON STREET, BOSTON.

DIRECTLY OPPOSITE FRANKLIN STREET.

☞ ORDERS BY MAIL ATTENDED TO. ☜

A JOLLY BOOK.

STUDENTS' SONGS,

A new collection of the newest and most popular songs as they are now sung at all the leading colleges throughout the United States.

60 MUSIC PAGES

WITH FULL PIANO ACCOMPANIMENTS.

POSTPAID, 50 CENTS.

MOSES KING . . . PUBLISHER,

HARVARD SQUARE, CAMBRIDGE, MASS.

FRIDAY, JUNE 1, 1883.

TOO MUCH RED TAPE.

THE relief of the party now at the international polar station at Lady Franklin Bay is attracting the attention of those interested in arctic matters. In this connection, Dr. C. H. Merriam has written a pungent but timely letter, printed in the *New York tribune* of May 5. The expedition of 1882 was prevented by ice from reaching a latitude where any effective aid might have been rendered, — a fact which made the alleged drunkenness and incompetency of the person in charge of the relief party of little practical consequence, except to his associates in the service. That they were not disturbed by it is evident from the fact that his despatch on similar service this summer has only been averted by remonstrances similar to and including Dr. Merriam's. Fortunately for the credit of the country and for Lieut. Greely's party, the plans have been changed, and it is probable that a person rendered competent for the position by experience and intelligence will be put in charge, and possibly accompanied by one or two qualified arctic experts in an advisory capacity.

It is well known, that, within the limits of the United States, the possession of a naval or military commission and a congressional appropriation fully qualify the holder for any scientific, technical, or moral undertaking. Some, however, have been audacious enough to doubt whether this law holds good in any foreign jurisdiction, and whether the floes of Baffin's Bay are sufficiently under its influence to recoil more readily before brass than before horn buttons. One thing is certain, the service concerned will be held to a rigid responsibility by geographers and the public; and if military prepossessions result in the rejection of any practicable (if unmilitary) means of succor, physical or mental, the condemnation of any ensuing failure or disaster will fall where by common sense and military rules alike it belongs.

It is well known to those acquainted with the subject, that good arctic navigators, masters, and seamen, good ships for encountering the ice, and every article necessary for equipping a properly fitted expedition, can, by paying for it, be got at St. Johns from the sealing-fleet and its equippers; that the bad ice-navigation of 1882, from all indications, is likely to be duplicated this season; that, to be more than a contemptible pretence, the relief-party must be composed, rank and file, of men who know their business, and have the grit to do it; that the advice and unbought assistance of all arctic investigators within reach may be had freely by the responsible head of the Signal-service.

Knowing this, and believing that officer willing and ready to do the best and most reasonable thing in the premises, we await final action in the confident belief that past mistakes are not to be repeated, and that the results of cutting red tape will be creditable alike to the service and to the country.

THE ALPHABET AND SPELLING-REFORM.

THE letters of the alphabet are so variously sounded in different countries that they could not be internationally employed, with phonetic consistency, without altering the whole orthography of the different languages. French and English, for example, could not, by any adaptation of Roman letters, be made phonetically intelligible equally to French and English readers. Try to write such phrases as '*la langue française*,' 'the English tongue,' so as to show the actual pronunciation of the words, and the utter hopelessness of the task will be apparent.

The letters *n* and *g* have three distinct sounds — different from their alphabetic sounds — in the three words in which they occur in the above illustrations. In the word '*langue*,' the *n* is used merely as a sign that the preceding vowel is nasal, and the *g* has the second of its two regular 'soft' and 'hard' sounds. In the word 'English,' the *n* has a separate sound, which is not that normally associated with the letter, and the *g* has the same sound as in '*langue*.' In the word 'tongue,' neither the *n* nor the *g* is separately pronounced; but the combination has a distinctive sound, which is not represented by any letter in the alphabet. This sound of the combined letters *ng* is the same as that of the *n* alone in the word 'English.' In 'hanger' and 'anger,' 'longer'

(one who longs) and 'longer' (comparative of long), 'singer' and 'linger,' etc., the same diversity in the use of these letters will be observed.

The sounds of the vowel letters in the above illustrations are equally diversified. The letter *a* in '*la*,' '*langue*,' and '*-çaise*,' has three sounds, the second of which does not exactly correspond to any English sound. The letter *e* in the words 'the' and 'English,' has two sounds, neither of which is normally associated with the letter as an alphabetic element, and the second of which does not correspond to any French sound. The letter *o* in 'tongue' has a sound which does not occur in French, and which is different from either of the regular 'long' or 'short' sounds of *o* in English. In addition to these diversities in the sounds of single letters, the above six words illustrate another anomaly in the use of combinations of letters to denote simple elementary sounds, — as *th* in 'the,' *sh* in 'English,' and *ng* in 'tongue.'

On account of the impossibility of reconciling the varied associations of sounds and letters in different languages, spelling-reformers are obliged to limit their efforts to a single language, and to disregard all hope of arriving at international uniformity. This latter could only be attained by means of such an alphabet as that of Visible speech, which obviates international difficulties by furnishing a *physiological* key to the sounds of all letters. But an important immediate use might be made of a few of the Visible-speech symbols, to supplement the Roman alphabet by furnishing letters for sounds that are at present unrepresented. Many of the anomalies of orthography would be removed in this way, and with a minimum of interference with established usage. It is well known that we have six consonant sounds, which, for want of separate letters, are written by digraphs, or by various combinations of letters. These are, —

sh — in *fish* [*ce* in *ocean*, *ci* in *vicious*, *ti* in *notion*, etc.].
zh[1] — [*s* in *pleasure*, *vision*; *z* in *azure*; *ge* in *edge*, *rouge*.]
th — in *thin*.
dh[1] — in *then*.
wh — in *when*.
ng — in *sing* [*n* in *ink*, *anger*, etc.].

Even objectors to spelling-reform would probably admit the desirability of adding letters to the alphabet for all acknowledged simple sounds. In the present paper, consonants alone are dealt with. Arbitrary letters have been often proposed, but they have not met with acceptance. The Visible-speech letters — being physiological pictures of the organic formation of their sounds, and in no sense arbitrary — might, with great advantage, be adopted in these cases.[1]

[1] This orthography of the intended sound nowhere occurs in practice; but Roman letters admit of no better way of writing the element.

New characters being wanted to supply the consonant deficiencies in our system of letters, there is no need to seek for forms in old or foreign alphabets, or to devise a set of arbitrary characters, when Visible speech offers for our use its physiological letters ready to fill every gap in our own or other alphabets. The following are the symbols which, in this system, denote the six unrepresented consonant sounds in English. The physiological meanings of the symbols need not be here explained; but the reader can judge of the simplicity of the forms, and of their adaptability for intermixture with ordinary letters, by the annexed illustrations.

	V.-s. symbols.	Script forms.
sh	Ω	ʃ
zh	Ω̣	ʃ̣
th	ω	ω
dh	ω̣	ω̣
wh	Ↄ	Ↄ
ng	ɞ	ɞ

ILLUSTRATIONS.

fish,	sheep,	catch,	ocean,	caution,	vicious,
fiΩ,	Ωeep,	catΩ,	oΩan,	cauΩon,	viΩous,
edge,	rouge,	azure,	measure,	vision,	usual,
edΩ̣,	rouΩ̣,	aΩ̣ure,	meaΩ̣ure,	viΩ̣on,	uΩ̣ual,
thin,	truth,	three,	author,	ethnic,	athwart,
ωin,	truω,	ωree,	auωor,	eωnic,	aωwart,
then,	this,	breathe,	either,	gather,	within,
ω̣en,	ω̣is,	breaω̣,	eiω̣er,	gaω̣er,	wiω̣in,
why,	what,	when,	whether,	awhile,	nowhere,
Ↄy,	Ↄat,	Ↄen,	Ↄeω̣er,	aↃile,	noↃere,
sing,	ink,	uncle,	angry,	sanctify.	
siɞ,	iɞk,	uɞcle,	aɞgry,	saɞctify.	

The advantage of adopting the required supplementary letters from a scientific and universal alphabet is, that the same additions, as well as others from the same source, may

[1] Those who are not acquainted with Visible speech, as a source from which letters may be drawn as wanted, may be referred to the judgment pronounced on the system by the most eminent authority on phonetics, Alexander John Ellis, F.R.S., who writes to the Reader (Aug. 5, 1865), "Until Mr. Melville Bell unfolded to me his careful, elaborate, yet simple and complete system, I had no knowledge of alphabetics as a science. . . . Alphabetics as a science, so far as I have been able to ascertain, — and I have looked for it far and wide, — did not exist."

be used, as required, in connection with any other language employing the Roman alphabet. For example: the sign of nasality in Visible speech is ∫; and this character might very conveniently replace the *n* and *m* used in French, as in '*bon*,' '*temps*,' '*enfin*,' etc. The peculiar sounds of *ch*, *g*, and *w*, in German, as in '*nach*,' '*ich*,' '*auge*,' '*wie*,' etc., have very simple representatives in the physiological alphabet, which might, with great benefit, be adopted in the Romanic writing of German. The following illustrations exemplify these suggested improvements in French and German phonetic writing: —

bo∫,	te∫,	e∫fi∫,	naC,	iՈ,	auЄe,	эie.
bon,	temps,	enfin,	nach,	ich,	auge,	wie.

The alphabet that expresses the speech of America, England, France, Italy, and Spain, is a wonderfully imperfect instrument; but it is more imperfect in relation to the sounds for which it is used in America and England than in the other countries. Common sense revolts at the unnecessary difficulties imposed on the young by those who have got over the difficulties for themselves; for it must be acknowledged that the efforts of spelling-reformers have been resisted on no better ground than that of conservatism of error and defect, because established. Orthography has been considerably modified for local uses in Spain, and, to a more limited extent, in France. To the English-speaking races remains the task of effecting greater modifications to remove not only local, but international difficulties. For this purpose the alphabet itself must be reformed. This paper shows how such a reform could most hopefully be commenced. But why not have two alphabets? The new letters, being purely phonetic, would be a key to old letters, not only in English, but universally; and then the venerated orthography of our literature might remain undisturbed.

ALEX. MELVILLE BELL.

A STUDY OF THE HUMAN TEMPORAL BONE. — II.[1]

THE *labyrinth* is a complex receptacle of the internal ear, embedded within the petrosa, with its long axis parallel with this, and occupying a position intermediate to the tympanum and the internal auditory meatus. Its cavity is enclosed with compact walls for the most part not distinctly differentiated from the rest of the petrosa. It consists of three portions, named the vestibule, the semicircular canals, and the cochlea.

[1] Continued from No. 14.

The *vestibule* is an irregularly ovoidal cavity situated between the tympanum and the internal auditory meatus, communicating with the cochlea forward and inward, and the semicircular canals backward and outward. In its outer wall is the oval window, opening into the tympanum, but closed in the complete condition by the base of the stirrup. At the fore-part of its inner wall is a circular concavity, the *hemispherical fossa*,[1] at the bottom of which is a little group of minute foramina named the *middle cribriform macula*. The fossa is defined by an acute margin, which expands at the roof of the vestibule in a low *pyramidal eminence*. This is perforated by a group of minute foramina, the *superior cribriform macula*. On the roof of the vestibule, outwardly and behind the fossa indicated, is another less defined, named the *hemielliptical fossa*.[2] At the lower part of this is the aperture of the fine venous canal,[3] which communicates with the cleft on the posterior surface of the petrosa. Below the oval window is the *cochlear fossa*,[4] which, in the prepared bone, communicates freely with the cochlea, but, in the recent state, opens only at its fore-part into the vestibular passage of the same. Externally, above and behind the hemielliptical fossa, the semicircular canals communicate with the vestibule.

The *semicircular canals* are three horseshoe-shaped tubes, traversing the compact substance of the petrosa outwardly from the vestibule, with which they communicate by five apertures. They are compressed, cylindrical, and each has one end expanded in a pyriform dilatation named the *ampulla*. The *posterior canal*[5] is longest, is directed vertically outward, and extends lowest; the *superior canal* is directed vertically fore and aft, extends highest, and produces the conspicuous prominence on the front surface of the petrosa; and the *external canal*[6] is shortest, and is directed horizontally outward on a level with the ends of the superior canal, and the middle of the posterior canal. The ampullae of the superior and external canals occupy their fore-ends, are contiguous, and open into the vestibule above the oval window. The ampulla of the posterior canal occupies its lower end, and opens into the lower back part of the vestibule. The hind-end of the superior canal, and the upper end of the posterior canal, conjoin in a common canal, which opens into the upper back part of the vestibule; and the hind-

[1] Fossa hemispherica, recessus sphaericus.
[2] Fossa hemielliptica, recessus ellipticus.
[3] Aqueduct of the vestibule.
[4] Recessus cochlearis.
[5] Internal or inferior.
[6] Median, horizontal, least.

end of the external canal opens into the latter at its middle back part.

In the ampulla of the posterior semicircular canal is a little circular group of minute foramina, the *inferior cribriform macula*.

The *cochlea*, named from its resemblance to a snail-shell, is situated inwardly, and in advance of the vestibule. It is a broad, low cone, placed on edge, with its base applied behind to the bottom of the internal auditory meatus, with its axis directed forward and a little outward, and with its apex contiguous to the eustachian tube and the bend of the carotid canal. Externally it produces the promontory, and internally its wall is separated from the exterior compact layer of the petrosa by the spongy substance occupying the interior of the apex of the latter.

The cochlea consists of a cylindroid, slightly tapering tube, the *cochlear canal*, which winds spirally round a central column, named the *modiolus*. The tube makes nearly three turns, gradually projecting in its course, and ending in a rounded summit, the *cupola*. From the round and oval windows, the cochlear canal turns downward, inward, upward, and outward, and continues in the same relative course to the end.

The *modiolus*, or central column of the cochlea, is conical, with a broad base excavated and impressed by the spiral tract at the bottom of the internal auditory meatus, and with its apex terminating immediately behind the end of the cochlear canal. In the course of the latter, the modiolus undergoes a rapid reduction, and, in the view of a longitudinal section of the cochlea, appears as a short, wide, cylindrical column, with a second short and narrow one projecting centrally from the former. From the middle of the modiolus, in the course of the cochlear canal, there projects a thin shelf, named the *spiral lamina*. This reaches about half way across the canal, partially dividing it into two passages. In the complete condition of the labyrinth, a membranous tube, the *cochlear duct*, extends along the cochlear canal, between the spiral lamina and the opposite wall, and completely separates the two passages. Of these, one communicates with the round window of the tympanum, and is hence called the *tympanic passage*,[1] while the other communicates with the vestibule, and is named the *vestibular passage*.[2] The two passages communicate with each other at the summit of the cochlea, within the cupola, by a common orifice.[3]

The turns of the cochlear canal being contiguous, in a longitudinal section of the cochlea, they appear separated by a partition extending from the modiolus to the periphery of the cochlea and gradually thickening as it approaches the latter. The partition is thickest at its commencement, and gradually becomes thinner in its course, until it abruptly terminates in a crescentic edge extended between the apex of the modiolus and the cupola. The interior surface of the cochlear canal, exclusive of the modiolus and spiral lamina, is imperforate and smooth. Opposite the spiral lamina it is commonly marked by a faint line, indicating the attachment of the spiral ligament.

The surface of the modiolus curves continuously from this into the surfaces of the cochlear canal and spiral lamina. In transverse section the canal appears more or less reniform.

The spiral lamina is widest at its commencement, opposite the round window, gradually narrows in its course, and ends in a hook-like process[1] projecting from the apex of the modiolus. At its commencement a narrower portion[2] is continued around to the opposite side of the cochlear canal, where it arches over the round window. The anterior surface of the spiral lamina is directed into the vestibular passage. A groove along its middle divides it into two zones, of which that next the free edge is the more compact and even. The posterior surface looks into the tympanic passage. The free edge is rounded and minutely serrulate.

The surfaces of the modiolus and spiral lamina are minutely porous for the transmission of vessels and nerves; and this condition is more marked within the tympanic passage.

Commonly a row of larger elliptical foramina, or pits, is situated within the latter passage, along the root of the spiral lamina, extending on the modiolus, giving this position a fluted appearance. The arrangement is of variable regularity, sometimes interrupted, and at times obscure. A narrower row of smaller and more numerous foramina occupies the base of the modiolus within the same passage. A row of small foramina is also variably conspicuous at the bottom of the modiolus, contiguous to the spiral lamina in the vestibular passage. Within this, also, the modiolus is more or less marked by minute radiating grooves, which advance and branch on the anterior surface of the passage.

The modiolus is composed of fine spongy substance defined by a thin, more compact layer. It is traversed by a ***central canal***, for the transmission of an artery, commencing at the central aperture of the spiral tract, and

[1] Scala tympanica. [2] Scala vestibuli. [3] Helicotrema.

[1] Hamulus. [2] Lamina spiralis secundaria.

ending at the apex of the modiolus. A larger *spiral canal* traverses it just behind and along the course of the spiral lamina, for the accommodation of the spiral ganglion. Numerous fine canals, communicating with the minute foramina of the spiral tract, likewise traverse the modiolus, for the transmission of the filaments of the cochlear nerve. The canals in their advance are successively reflected to open into the spiral canal of the modiolus.

The spiral lamina is composed of two delicate compact layers, with an intervening delicate spongy layer, which is traversed with numerous fine radiating and anastomosing canals. These communicate with the spiral canal of the modiolus, and terminate in minute apertures at the free edge of the spiral lamina.

The tympanic passage of the cochlea is directed from the round window downward, forward, and inward. It is crossed below, just in advance of the window, by a little crest,[1] to the inside of which is the aperture of the fine venous canal communicating with the pyramidal pit of the jugular foramen. The vestibular passage communicates with the vestibule internally to and above the tympanic passage, and below the position of the oval window.

The round window looks outwardly from the tympanic passage into the arched recess at the back of the promontory. It is beneath and a little external to the position of the oval window, from which it is separated by a vaulted arch formed by the upper part of the promontory. It is irregularly circular or somewhat oval, and about a third less in size than the oval window.

[1] Crista semilunaris.

GLACIAL DEPOSITS OF THE BOW AND BELLY RIVER COUNTRY.

DURING the progress of the geological examination of the Bow and Belly River country, which lies for the most part in the drainage-area of the South Saskatchewan, north of the 49th parallel, and immediately east of the base of the Rocky Mountains, several points of considerable interest and importance in the history of the glacial period have been observed. These observations, though made in the summer of 1881, have not yet been published; and, as it is hoped that the work of the coming season may add largely to our knowledge of this and neighboring districts, a detailed report is likely to be still further deferred. A brief general notice may in the mean time be of interest to the readers of SCIENCE.

A systematic account of the 'surface geology' of this and other districts in the vicinity of the 49th parallel was first given by the writer in 1875.[1] Observations were, however, at that time, necessarily confined more or less closely to the neighborhood of the 49th parallel. The late examination of the Bow and Belly country has been much more complete, embracing an area of about 20,000 square miles. The surface of this region declines, but not uniformly, from a height exceeding 4,000 feet along the base of the mountains to about 2,500 feet in its eastern and north-eastern parts. With the exception of a strip of country which may be designated as the foot-hills of the Rocky Mountains, the whole of this tract is covered more or less deeply with material which may be generally referred to as 'drift.' Over considerable areas this covering is from 100 to 200 feet in thickness; but in other places it is comparatively scanty, particularly on some of the more elevated plateaus of cretaceous and Laramie rocks. During later tertiary time the country has evidently been subjected to very extensive denudation; and its surface must have been much more diversified at the onset of the glacial period than it is at present. The drift deposits have evidently filled pre-existing hollows and low tracts; and the general effect has been a filling-up of its irregularities, and the production of wide areas of almost level prairie country. In cutting out their beds anew in the modern period, the rivers have in some places exposed fine sections of the cretaceous and Laramie rocks, while in others the base of the drift deposits has not been reached.

Resting immediately on the surface of the cretaceous and Laramie rocks in a number of localities on the Bow, Belly, Old Man, and other rivers, is a deposit of well-rolled pebbles or shingle, consisting, for the most part, of hard quartzites, and derived entirely from the paleozoic rocks of the Rocky Mountains. These pebbles are seldom more than a few inches in diameter, and often very uniform in size. The deposit has been observed to extend to a distance of over a hundred miles from the base of the mountains. Whether it has been carried from the mountains entirely by the action of rapid streams of preglacial times, or has been distributed in some more extended body of water, I am as yet unprepared to decide; but the fact that it occurs at very different elevations above the present water-level in neighboring sections on the same river, would appear to point to the latter conclusion. No marks of ice-action have been found on the stones of this deposit, which at one place on the Belly

[1] Quart. journ. geol. soc., Nov., 1875. Geology and resources of the 49th parallel.

was observed to be associated with stratified sand-beds.

Resting upon the shingle deposit in some localities, but in other places directly on the cretaceous and Laramie, is the bowlder-clay, a mass of sandy clay, often very hard, and not infrequently showing a pretty well marked relation in colors and material to the underlying soft rocks, from which it has evidently been largely formed, but packed irregularly with bowlders and fragments of Laurentian and Huronian origin, often distinctly glaciated, and with quartzite pebbles resembling those above described. While generally rather massive in character, the bowlder-clay is frequently more or less evidently divided by stratification-planes, and is quite distinct in appearance from the morainic accumulations which occur in the foot-hill belt.

The upper part of the bowlder-clay is usually much more distinctly stratified than the lower, and often more or less markedly lighter in color, though still holding numerous stones and bowlders of mingled Laurentian and Rocky Mountain origin. In the region through which the lower part of the Belly River cuts, a series of well-stratified sands and sandy clays are intercalated between these two divisions of the bowlder-clay; and in several sections these were observed to include an irregular layer of impure lignite or indurated peat a few inches in thickness, evidently the accumulation in a swamp or shallow lake which must have covered many miles of surface. A thin nodular deposit of ironstone was also found in association with the lignite at one place. This is the first evidence of an interglacial period, or interruption of the severity of the glacial conditions, which I have met with in the area of the great plains; but the facts are here perfectly clear and conclusive.

The surface of the plains generally is often strewn more or less thickly with erratics, which, except in the immediate vicinity of the mountains, are usually derived from the Laurentian axis; and, as they are frequently larger than any of those characterizing the bowlder-clay of the neighborhood, there is reason to believe that they belong to a subsequent period of dispersion. Several very large bowlders of Huronian quartzite occur near the Waterton River, not far from the western limit of the Laurentian and Huronian drift. One of these measured $42 \times 40 \times 20$ feet; and as no rocks at all resembling that of which these bowlders consist, or the gneisses and granites of the Laurentian, occur in the eastern ranges of the Rocky Mountains (which are everywhere here continuous and wall-like), there can be no doubt as to their eastern or north-eastern origin. As already stated in my Boundary commission report, the western margin of the region characterized by Laurentian and Huronian drift is here about seven hundred miles from the nearest part of the Laurentian axis, and within a few miles of the base of the Rocky Mountains.

In the publications above alluded to, a number of cases have been instanced, of the great elevations reached by erratics of eastern origin in the western portion of the Great Plains. The following additional examples from the district now in question may be added. The heights given are barometric, but have been worked out by comparison with the U. S. signal-service observations at Fort Benton, and may probably be depended on to within fifty feet. At the summit of the high ridge crossed by the trail between Fort MacLeod and Pincher Creek, Laurentian stones were found at an elevation of 4,390 feet; near the summit of the Rocky Spring Ridge, on the trail from Benton to MacLeod, and at several points about the intersection of the 49th parallel with the western branch of Milk River (long. 113°), at elevations between 4,100 and 4,200 feet. On the flanks of the W. Butte (lat. 49°, long. 111° 30′) Laurentian bowlders of small size, and pale limestone resembling that of the Winnipeg basin, are abundant at an elevation of 4,600 feet, while the highest actually observed fragments attained an elevation of 4,660 feet.

Evidence of the fact that glaciers of considerable size debouched from the valleys of the Rocky Mountain range is found in many places. The grooving and fluting of the limestone rocks near the efflux of the Bow River from the mountains, and the moraines strewn with bowlders of local origin near the mouth of the South Kootanie Pass, and thence for thirty miles or more northward along the base of the range, may be specially noted.

In the foregoing notes no theoretical explanations of the facts have been advanced. These have been elsewhere discussed. In the publications above referred to, I was, I believe, the first to define the so-called Missouri côteau as one of the most gigantic monuments of the glacial period of the continent, though arguing against its formation as a moraine. In whatever way the origin of the côteau may eventually be decided, it is, however, well to remember that it holds a position on the northern plains scarcely more than midway between the Laurentian axis and the western margin of the Laurentian drift, and that the transport of material to a much greater distance, and to twice the altitude of the côteau region, has also

to be accounted for,— facts, possibly, best explained on the supposition of a greater subsidence of the western as compared with the eastern regions leading to submergence of the plains under water sufficiently deep to carry icebergs of large size.

George M. Dawson.

Geol. survey of Canada, Ottawa,
April 10, 1883.

THE NAPLES ZOÖLOGICAL STATION.

I.

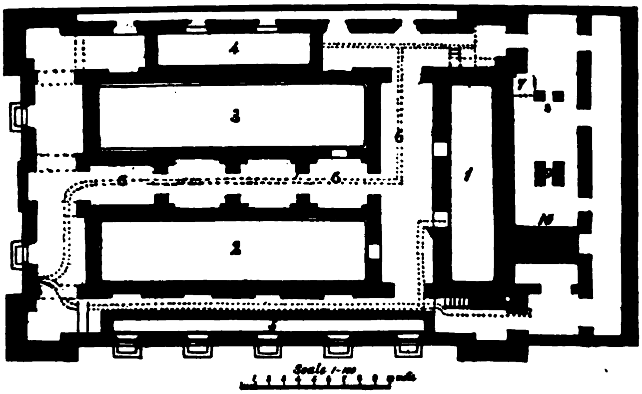
For half a century past, Naples has been the favorite resort of the zoölogists of Europe on account of the wealth of the fauna of the neighboring waters. But the independent efforts of solitary naturalists were naturally unable to secure all the advantages for science which could be gained by suitable organization. Two old fishermen, who, forty years ago, were turned aside from fishing for the market, and trained to collect for science by Johannes Müller, are still at work in the gulf, not now alone, but with a dozen other men, collecting with dredges, nets, hooks, and scaphandra, material for nearly thirty investigators, studying with all the resources of a completely organized laboratory in the zoölogical station.

Dr. Anton Dohrn, in his voyages to the Mediterranean to carry out his researches, experienced, as others had done, grave difficulties which he could not, single-handed, overcome. To realize the conditions necessary for extensive and thorough work requires not only a large expenditure of money and time, but a permanent and growing institution, which provides all the instruments of research in a locality where nature furnishes in abundance and variety the material to be studied. To carry on biological work on a large scale in as many directions as possible, with a thoroughly equipped laboratory, permitting investigators to apply to their researches the most elaborate technical processes, and to make use of the best modern methods, with all the material that these rich southern regions can supply, all the help that may be had from a well-furnished library, all the aid that can be obtained from well-trained attendants and subordinates, and all the stimulus and assistance that consciously and unconsciously comes from the intercourse of many minds giving their best powers to the same work, — this is the aim of the zoölogical station. To this object Dr. Dohrn has devoted the last fifteen years of his life, making even his own important researches a secondary consideration;

and, having founded the station, he has gathered about him a group of earnest investigators, animated by the same spirit, who form its permanent scientific staff.

The station was opened in 1874; and the total cost of its building was $85,000, exclusive of the cost of the site, which was given by the Neapolitan municipality. Dr. Dohrn contributed $60,000 of his own property, and obtained a grant of $20,000 from the German government. The other $5,000 was presented by some of the eminent friends of science in England, — Professor Huxley, Sir Charles Lyell, Mr. Darwin, Mr. Balfour, and others.

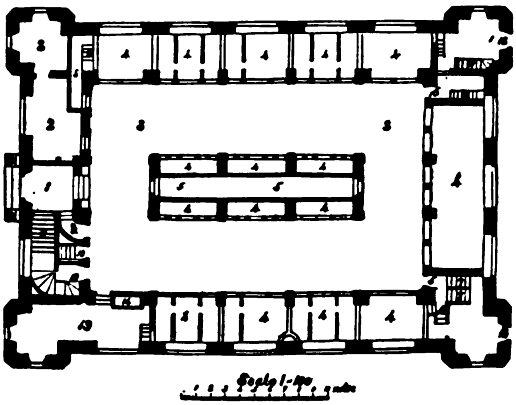
The situation of the building is exceedingly fortunate; it stands in the middle of the gardens of the 'Villa nazionale,' a few rods from the shore; and from its loggia one looks southward, over the wide expanse of the gulf, to Capri in the distance, westward to the ridge of Ponlippo, eastward to the mountains of St. Angelo, while to the north-east the town rises in terraces from the bay, in the form of an amphitheatre, with the smoke of Vesuvius in the background, rising into the sky, and floating away towards the horizon.



PLAN OF BASEMENT.

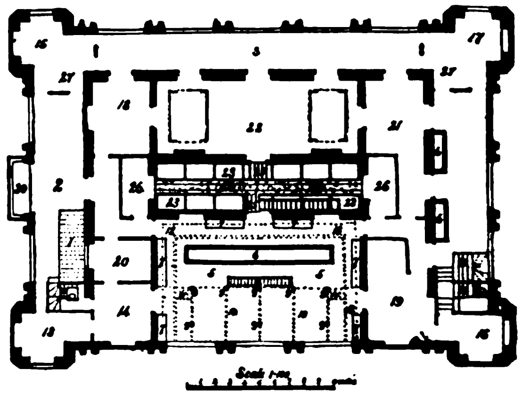
1. West reservoir; 2. South reservoir; 3. North reservoir; 4, 5. Storage basins; 6. Pipes connecting the reservoirs and basins with the pumps; 7. Pump-reservoir; 8. Pumps; 9. Engine; 10. Boiler.

The lower floor of the station is occupied by the well-known public aquarium, which consists of thirty tanks, the largest holding two thousand cubic feet of water. The beautiful creatures of the Mediterranean are to be seen in these tanks, living in their natural conditions, — the delicate transparent pelagic animals, the medusae, ctenophores, and salpae, the expanded corals and polyps and tube-worms, with their brilliancy and variety of



PLAN OF GROUND FLOOR, OR AQUARIUM.

1. Entrance; 2. Office; 3. Open space for visitors; 4. Aquarium; 5, 6. Passages and staircases for the service of the basins; 7. Staircase to laboratory; 8. Main staircase to same; 9. To basement; 10. To retiring-rooms; 11. To engine-room; 12. Entrances for fishermen and attendants; 13. Small laboratory; 14. Working aquarium of the same.



PLAN OF UPPER FLOOR, OR LABORATORY.

1. Main staircase; 2. East loggia; 3. South loggia (both open); 4. West loggia, closed by windows; 5. Large laboratory; 6. Working aquarium; 7. Large cabinets; 8. Iron staircase leading to 10, platform at mid height supported by iron pillars (9); 11. Staircase leading to 12, gallery destined for the collections, but at present used as the library; 13–18. Unfinished rooms attached to the laboratory; 19, 20, 21. First, second, and third assistants' rooms; 22. Great hall intended for the library; 23. Lighted court; 24, 25. Longitudinal and transverse passages through the same; 26. Vestibules; 27. Restaurants; 28. Staircase to aquarium; 29. Staircase to attic; 30. Chimney; 31. Balcony.

color, and the thousand other creatures of various size, up to the large octopus and the great edible turtle. The aquarium was intended to produce a revenue which should cover a considerable proportion of the expenses of the station, — an expectation which has not been fulfilled. Nevertheless, it is appreciated by all who visit it as a source of great delight and interesting knowledge, while it is indispensable to those who work in the station as a means of study and a reservoir of material.

Beneath the floor of the aquarium is a labyrinth of underground rooms, containing the engines, cisterns, and pumps by which the circulation of water is maintained throughout the tanks and the smaller aquaria in the laboratories above.

To the right of the main entrance to the public aquarium is a marble staircase, which the uninitiated are forbidden, in various languages, to ascend. It leads up to the part of the building devoted to scientific studies; and thus immunity is secured from all noise or disturbance. The naturalists at work hear only the breaking of the waves, or, at times, the sounds of music from the gardens, and the distant murmur of the city. On the northern side of this second story is the great laboratory, lighted by a row of windows twenty-five feet in height. It is fitted up for twelve workers; the tables, drawers, and shelves of each being so arranged as to form under a window a kind of alcove, which is thus well lighted from the north, and is fitted up independently with reagents and apparatus. Down the centre of the room is a long aquarium, consisting of two reservoirs, one above the other; so that, by means of siphons, circulation of sea-water may be kept up in the various vessels which the occupants of the tables use to isolate the animals they are studying, or to contain ova and embryos in course of development.

Besides this general laboratory, there are twenty small rooms fitted up for the same purpose, each provided with its own apparatus and aquaria.

The south side of the large laboratory has two windows opening on a central court lighted by a skylight in the roof, and extending down to the floor of the public aquarium, whose central tanks are arranged around it. A short bridge across this court leads to the library, which corresponds in size to the laboratory, and opens on to a spacious loggia running along the whole south side of the building. The library is well furnished and excellently lighted; and there is scarcely a work on any branch of biology, classical or recent, or any current scientific periodical of reputation, which is not to be found on its shelves. The height and fine proportions of the room are in keeping with the dignity of its function; and its walls are tastefully decorated with interesting frescos appropriate to the situation and character of the station.

To the west of the laboratory and library are the rooms where the material brought into the station is deposited, sorted, and distributed, and where the conservator, Salvatore Le Bianco, and his assistants, preserve specimens for the collection of the station, and for sending to distant laboratories or private investigators. In one of these rooms are the shallow tubs where the contents of the dredges are poured out, washed, and searched by a number of boys; and the variety of beautiful and interesting creatures to be seen here, everywhere around, produces an enthusiastic delight in the zoölogist on his first visit; and the impression is in no way lessened when he examines the exquisite collection of preserved specimens in Salvatore's room, and sees the most delicate and sensitive creatures — corals, alcyonaria, transparent medusae, and ctenophores — fixed in the fully expanded condition, and preserved in their natural shape. This result is obtained by a different method for almost every animal; and the successful treatment has been discovered, sometimes by a fortunate idea, but usually by patient and careful series of experiments.

THE SPECTRUM OF AN ARGAND BURNER.[1]

I HAVE been lately requested to determine the distribution of energy in the spectrum of an argand burner, and have been able to do this by means of the apparatus and methods previously employed at the Allegheny observatory for mapping the invisible spectrum of the sun. The results are curious; and, in the hope that they may also be found useful, I desire to communicate them to the academy. The difficulty in such a determination lies in the mapping of something which is wholly invisible; and it has not been made before, I presume, in spite of its economical importance, because there has been no means known of measuring this invisible energy, except in a rough way, by the thermometer or thermopile, by a process which gives incomplete results.

It was my object not merely to indicate

[1] Read before the National academy of sciences at its Washington meeting, April, 1883.

how much of the radiation from a gas-burner was visible, and how much was not, but to give a map of its distribution on the normal or wave-length scale, which would enable any one to see the quality and amount of the energy in each part of the light and heat region.

The ordinary argand burner, burning common house-gas within a glass chimney, was first placed at the centre of curvature of a large Rowland concave grating; and, by means of the bolometer, the heat was measured at successive points in the spectrum down to a wave-length of about .001 mm., where the overlapping second spectrum began to be sensible. Even in the preliminary determination, it was interesting to observe that the distribution of the heat was totally different from that in the sun, and that, instead of growing smaller, it grew greater, as the bolometer passed from the visible to the invisible end. As it was evident that the heat was still increasing at the point where the evidence from the grating failed, all the measures were next repeated with a prism of a special glass known to be transparent to the invisible rays. (It was first attempted to use the linear thermopile; but the heat was insufficient, and the linear bolometer was substituted.) With this, as many as thirteen ordinates were measured (representing the proportionate heat at as many points), their respective indices of refraction being determined by the known refracting angle of the prism and the observed deviations on the circle of the spectro-bolometer.

In a late communication to the academy, I gave the results of a recent research upon the connection between indices of refraction and wave-lengths, which enable us to deduce the normal spectrum (invisible as well as visible) from the prismatic one. It appeared to me when I was engaged in the first investigation, which to all but students of the subject must seem abstruse, that its results were of a kind which could never have much other than a theoretical interest: but it happens that this their first application is of a utilitarian character; for, having thus converted the prismatic values into corresponding ones on the wave-length scale, I was able to represent the conclusions from both by the normal maps which I now have here, and which exhibit the results of the analysis of the radiant heat which has come through the chimney. Let us remember that this radiant energy differs wholly in its qualities in different parts, and that the quality is shown by the wave-length number on the horizontal scale; the amount, by the height of the curve at that point. Near the part with wave-length .5 it gives the eye the sensation we call blueness, and near .7 it appears as a dull red, bringing very little light; at the point .9 or .10 it makes on the most sensitive eye no impression whatever, but has the power of passing freely through the glass chimney; near .3 the glass, so transparent to the light, is almost wholly opaque to the energy: so that each part has some quality peculiar to itself. By far the most important of these qualities, for our present purpose, is that of giving light. If we then analyze the radiant energy which comes through the chimney, the result is shown in our lower curve. The energy, which is what the gas supplies at the cost of the production from the coal, is for our present purpose regarded as saved or wasted, according as it is visible (light) or invisible (dark heat). The energy first becomes measurable in the blue, where there is very little of it, but where all there is, is effective as light; it increases steadily to the extreme red ordinarily visible where there is a great deal of it, but of a quality which is only interpreted by the eye as a dull reddish glow of little value for lighting; and then goes on increasing where it passes into complete invisibility, and still continues to increase as (for the present purpose) *pure waste*, till its maximum is reached at a wave-length of 1.5 or 1.6, — something like three times the length of the visible spectrum below the lowest visible ray. The energy at any point being proportional to the height, the entire radiant heat is proportional to the area of the curve. If we draw it on such a scale that this whole area equals 100, we can see the percentage expended in any kind of radiation at a glance. The small, nearly triangular area to the left of the line at .7, for instance, represents all the radiant energy useful as light; and this area being by measurement 2.4, while that of the whole curve is 100, we see that 2.4% are employed as light, and the remainder, 97.6%, are wasted. But this refers to the *radiant* heat alone, and takes no account of that expended in heating the air by convection currents. I have heard this latter estimated at three-quarters of the whole, but have not myself measured it. Admitting that this is approximately correct, however, it follows, that, since only one-quarter is radiated, it is 2.4% of this one-quarter only, which is light, and that finally less than 1 % of the whole is used, and more than 99% wasted.

It is instructive to take an amount of solar

energy exactly equal to that we have just analyzed in the gas-burner, and notice how totally different it is in kind. The upper curve shows the distribution of such a small sample of the sun's radiation as shall be exactly equal to that from the argand burner. Of 1,000 parts of sun energy, 340 appear as light, and 660 as dark heat, if we take the dividing-line between light and darkness at the same point (wave-length 0.0007 mm.) in each curve. If we look at the quality of the light, the difference is enhanced. The sun-curve attains its greatest height in the yellow, which here means that the energy is not only most efficient in making us see (that is, is most available as light), but that of this light the energy is again most effective in a part to which the eye is most sensitive, while, of the small amount of energy employed by the gas in making us see at all, most (as shown by the height of the curve in the dark red) is spent in rays to which the eye is not sensitive, and which give the gas its well-known inferiority in quality (of color) to sunlight, even where the quantity is the same.

Similar curves obtained for the electric light would be interesting, but I have not undertaken them.

We are accustomed to indicator and other diagrams in the use of the steam-engine, showing us how our energy is being generated; but it is singular that so little has been done in the present direction in showing us with what economy it is being employed. I think interest attaches to these curves from a purely scientific stand-point, and they were made with no ulterior purpose. Yet in looking at them I can but be so impressed with their utilitarian applications that I will ask leave to make a remark in conclusion with reference to this.

Distribution of radiant energy in the spectrum of an argand gas-burner.

The gas-plant of this country is said to be some $30,000,000; and (except so far as it is used in heating) it appears from what has just been said, that it is mostly wasted as compared with the results possibly attainable, and in the sense that it does not realize one one-hundredth of what an ideally perfect lighting-agent might get from the coal now used. Though this ideal light will never be fully realized, it is undoubtedly possible to do what

we see actually done in sunlight; and thus whoever can, without altering the quantity, effect this change in the quality of the radiation from gas, will add millions to the national wealth. S. P. LANGLEY.

THE NEW-YORK AGRICULTURAL EXPERIMENT-STATION.

THE weekly bulletins of the New-York experiment-station, although "intended to inform the public of progress at the station rather than to give complete results," nevertheless contain some matters of interest.

Seeds. — A series of weighings on light and dark colored seeds of several kinds showed, that, in every case, a hundred dark-colored seeds were heavier than the same number of light-colored seeds. The dark-colored seeds were also found to contain a larger percentage of seeds capable of germination. Sprouting-trials with onion-seed of different ages indicated that seed over two years old is of little value. Confirmation was obtained of the results of Will on the regermination of seeds, reported on p. 176 of SCIENCE. Out of a hundred kernels of corn, eight germinated for the fifth time after drying in the air. Both field-experiments and sprouting-trials showed a decided superiority, as seed, of corn taken from the tips of the ears over that taken from the butts or the middle.

Potato-culture. — The terminal eyes of the potato were found to germinate more promptly and vigorously than the basal eyes. The best crops were obtained, and at the least expense of seed, by cutting the potatoes to single eyes, and so cutting them that each eye retained a portion of the tuber extending as far as possible towards the central axis. Each eye may be regarded as the terminal bud of a branch extending from the central stem; and the potato should be so cut that each bud may retain all, or nearly all, of its branch. The conditions favoring the production of potatoes seem to be moisture and coolness for the roots, and warmth and dryness for the tubers. Culture which supplied these conditions, such as ridge-culture, and, still more, covering the seed-potatoes with four or six inches of sand, gave a large increase over level culture.

Root-development. — By excavation and washing, the development of the roots of several species of plants has been traced. Corn seemed to have two systems of roots, — one of fibrous roots, developing chiefly in the upper and warmer layers of the soil; and the other of coarser roots, passing downward into the subsoil. The hypothesis is advanced, that the former system serves mainly to supply the plant with ash ingredients, and the latter with water, and perhaps nitrogen. Wheat and potatoes appear to be deep feeders, developing their roots more abundantly in the lower and cooler layers of the soil. Tobacco, on the other hand, is a shallow feeder, like corn.

Feeding-experiments. — A single determination of the digestibility of corn-ensilage gave the following percentage results: —

Proteine	51.89
Fat	79.17
Crude fibre	60.91
Nitrogen free extract	67.59

The figures for proteine particularly are lower than those given in Kühn's tables of digestibility; and the conclusion is drawn, that the process of ensilage has decreased the digestibility of this ingredient. The conclusion is, however, entirely unwarranted; for the figures simply show that the ensilage was less digestible than Kühn's corn-fodder, but show nothing whatever about the digestibility of the corn-fodder of which this ensilage was made.

A series of feeding-experiments on milk-cows was carried out, the fat in the milk being determined chemically, while, at the same time, the butter obtainable from it was determined by actual churning. The interesting result was reached, that, with different rations, the amount of butter fluctuated much more than that of the total fat: in other words, the feeding seemed to make a difference in the completeness with which the butter could be extracted from the milk. A ration of shorts and hay gave the best results in this regard. Other interesting minor results were obtained, but the main object of the investigation is not very apparent from the account given in these bulletins. The coarse fodder was eaten *ad libitum*, the amount of water drunk was not regulated, and no sufficient data are here presented for a comparison of the different rations. It is to be presumed, however, that some of these deficiencies will be supplied in the formal report of the station.

An analysis of the milk of fatigued cows showed that it was quite phenomenal in character, the total solids being nearly a third greater than the normal amount, and the increase being nearly all in the fat.

H. P. ARMSBY.

CLASSIFICATION OF ISLANDS.

A. KIRCHHOFF (*Kettler's zeitschr. wissensch. geogr.*, iii. 169) presents some criticisms on Peschel's and Wallace's work in this direction, and proposes the following table. A, Festländische inseln: *a*, Abgliederungsinseln; *b*, Restinseln. B, Ursprüngliche inseln: *a*, Submarin enstandene vulkanische inseln; *b*, Aufschüttungsinseln; *c*, Nichtvulkanische hebungsinseln. The first group includes those derived from a continental land-mass, either by submergence or seashore erosion, the latter being uncommon. Its first subdivision (dismemberment-islands?) are found along the borders of existing continents, and are very numerous. The second subdivision (remnant-islands?) would include the last surviving summits of a drowned continent; but no examples are surely known, unless those of the Antarctic Ocean belong here. These continental islands might be of volcanic rocks, for the higher points of many existing continental districts are of volcanic origin: they are not necessarily of varied geological structure, as described by Wallace. Witness the monotonous low quaternary islands along the German seacoast. And, while it is true that land mammalia and amphibia are wanting on islands of the second group, it is an error to say, with Wallace, that they are always present on those of the first. Wallace recognizes that elevation, after a complete though short submergence, would reveal the island bereft of its earlier continental fauna, but finds no examples of such a result. Kirchhoff adduces the Halligen Islands of the North Frisian group as such examples; for their low surface is frequently submerged by high winter tides, leaving only the huts crowded on artificial mounds above water. They have no mammals (except the domestic); moles are unknown in their green meadows; nor have they toads or frogs. Larger examples of the first group are seen in Greenland and the archipelago north of British America; in the West Indies, once connected with South America, Florida being of comparatively modern extension towards Cuba; New Guinea; and Borneo.

Madagascar and New Zealand are of older separation, the latter approaching the *restinseln*.

The term 'oceanic' is discarded for the second group, because islands may be formed *de novo* close to continental shores; but the term proposed ('original') is not altogether satisfactory, as it does not express precisely what is meant. The first subdivision (volcanic islands) contains the most important examples, which have sometimes, from their considerable age and altitude, acquired peculiar and local organic forms. The second subdivision (heaped-up islands) includes those of coral and of sand, on which the dry surface is due to wave and wind action. These are all low and monotonous. The third subdivision includes portions of the sea-bottom laid bare by non-volcanic action, either by local elevation "or by withdrawal of the sea formerly held at a higher level by the local attraction of mountains or ice masses that have now disappeared." A single example of recent formation is given, — the so-called 'Gulf-stream island,' northwest of Novaya Zemlya, where the Dutch navigators of 1594 found a sand-bank in seventeen fathoms of water. Peschel's error of placing the Japanese and Philippine islands among the volcanic is corrected: they are included among the continental, as both contain a series of old non-volcanic rocks.

W. M. DAVIS.

LETTERS TO THE EDITOR.

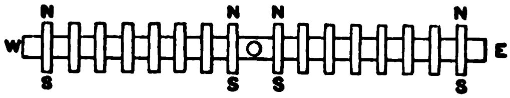
A new form of battery-cell.

IN the ordinary voltaic element, two solid plates are acted upon unequally by one or more liquids. About three years ago, it occurred to me to construct a battery-cell with three non-miscible liquid strata, and no solid plates; which I did, as follows: in a small beaker-glass I placed successively layers of mercury, dilute sulphuric acid, and a solution of iodine in ether. Upon connecting the uppermost and lowest layers with insulated wires, and introducing a coarse galvanometer into the circuit, I obtained evidence of a fairly strong current of electricity. Having neither time nor opportunity to pursue the matter further, I put it on record now in order that any student who happens to be interested in the subject may carry out the investigation. Theoretically, a three-liquid cell is interesting, because its internal resistance ought to diminish with rise of temperature. In this respect it might be very different from the usual voltaic elements. Possibly a combination of solid plates with the upper and lower liquids might give a cell having an internal resistance constant for varying temperatures. F. W. CLARKE.

Correcting compass deviation.

Some years ago, frequently recurrent shipwrecks from magnetic disturbance in the Gulf of St. Lawrence directed my attention to the subject of improving the mariner's compass, or supplementing it in some way which would make its indications trustworthy. The causes of the shipwrecks which I have mentioned seemed to be deposits of iron ore near the shore, so extensive in their area as to render the compass-reading false and misleading. The problem of improving the compass is an important one; for, apart from such risks as those which beset navigation in the Gulf of St. Lawrence, the deviation on board ship due to the presence of iron in the structure or cargo of the vessel is an element of some uncertainty, and danger even, when all the devices known to the mariner's art are used to correct the readings.

My first attempt was to so dispose a series of small flat magnets, fastened across a strip of aluminum, that the strip as such, when poised at its centre, pointed east and west.



Poised concentrically with the strip at such a distance as to avoid mutual influence, I placed a light magnetic needle of a length equal to that of the strip. When strip and needle were near enough to a piece of iron to be attracted by it, one of the two acute angles formed by them indicated the position of the disturbing iron; and this inclination at an acute angle promised to be of value in solving the problem of correcting compass-readings. But magnetic influence on the large scale which prevails on shipboard proceeds from distant centres along large curves, in which terrestrial and local forces merge, which are not attractive, but simply directive; so that when I tried my device on a steamer under very favorable experimental circumstances, as the magnets, large and small, were directed into curves so great as to be practically straight lines, the needle and strip were always at right angles with each other. Were it feasible to use a very long magnetic strip at sea, my device might be available; but, so long as ships roll and pitch on the ocean's unruly surface, the dimensions of the ordinary compass must remain as they are. Since abandoning the fragile little model which I launched with some expectations long ago, I have frequently reverted to the problem it was intended to solve; and it has occurred to me, that were an electro-magnet poised so as to be in constant and free communication with a battery, and were it possible to make it, when desired, so intense in its power that its induction affecting the iron of ship or cargo should increase the deviation which, when less intensely excited, would affect it, then the direction of the deviation would be, of course, known by the direction of the increase of that deviation, and the problem of correcting the compass-reading would be advanced a step. The intensity of the electro-magnet would yield such results as a long (impracticably long) magnetic strip. The electro-magnet would require to be so constructed as to be capable of developing the utmost intensity possible; and the current sent through it should be controllable at will, so that the indications at moderate and highest intensity might be compared. I have neither the skill nor opportunity to carry out the suggestion here given, and publish it in the hope that some competent man of science may be able to embody it in a practical and useful form. GEORGE ILES.

Montreal, May 25, 1883.

MAINE'S EARLY LAW AND CUSTOM.

Dissertations on early law and custom. By Sir HENRY SUMNER MAINE, K.C.S.I., LL.D., F.R.S. New York, *Henry Holt & Co.*, 1882. 402 p. 8°.

WHEN a new book by Sir Henry Maine is announced, we expect to have something to read worth reading. Nor have we ever been disappointed. The author of 'Ancient law' has always something interesting, suggestive,

instructive, to say. He gathers up the gist of contemporary thought, and presents it in a simple, lucid way, and always contributes something new from his own mind. The specialist finds, sometimes, a lack of definition, of exhaustive analysis, and here and there more or less serious errors. In spite of this, however, he must admit that we have no more interesting, no more instructive writings than these; that the reasoning is generally clear and sound; that the errors are, as a rule, incidental.

The present volume is divided into eleven chapters, to one or two of which notes of some length are appended. The first four chapters are devoted to early law in its relations with religion. Ancestor worship is discussed at length. We are told how the worship of father, grandfather, great-grandfather, and other ancestors, remembered or capable of being remembered, has among the Hindus a most elaborate liturgy and ritual. Our author thinks that wherever ancestor worship arose paternity must have been recognized. The father's power must, he tells us, have been antecedent to the practice of worshipping him. This seems a sound conclusion. When, however, we are told that ancestor worship preceded the existence of laws of inheritance, we demur. It is quite possible that ancestor worship originated as an expedient for preserving the knowledge of genealogical relationships, inheritances being determined according to these relationships. It has been very well said by Mr. Skene, that the genealogical table was to early society what the title-deed has been to society of medieval and modern times.

In chapters v. and vi. our author takes up the subject of royal succession and kingship in its connection with early civil justice. These chapters are very instructive. But on p. 131 we find the following statement: 'The past of the west lives in the present of the east.' This seems to us open to some criticism. Does our author mean to say that the gaps in the early history of the west may be filled up by importations of eastern custom? If so, we must make a protest. This is a very dangerous method, and not a scientific one. Without doubt, existing institutions in the east suggest to the student of institutions in the west hypotheses which he may profitably use *as hypotheses;* but they must not be used in any other way. The late Mr. Morgan was led into many errors by filling gaps in the history of one nation by extracts from the history of others. We remember our astonishment when we read his account of the Roman *gens*, in which he fills up the blank spaces of Gaius with importations from America. We are not a little pleased to see that Sir Henry Maine does not follow him in this. He says (p. 283), "The Agnati were a group of actual or adoptive descendants, through males, from a known and remembered ancestor: the Gentiles were a similar group of descendants from an ancestor long since forgotten." His note upon the *gens* is extremely interesting and valuable.

Chapter vii., upon the theories of primitive society, will, perhaps, be read with more interest than any other in the book. It is an argument to support the theory of patriarchal families against the theory of promiscuous hordes, against the theory of McLellan and Morgan. Have we any right to assume that the intercourse of men and women was in early times promiscuous? Sir Henry Maine thinks not. The first fact in sociological development is, according to his view, the family. Promiscuous intercourse, in so far as it has existed, he regards as due to the cultivation of unnatural, abnormal instincts, or else to a deficiency of women at certain times and in certain places. The origin of the family he traces to sexual jealousy, which he describes, rightly enough, as one of the strongest of animal instincts. In short, he takes very much the position which Mr. Darwin takes in his account of the descent of man. Sir Henry Maine defines the patriarchal family as the result of sexual jealousy indulged through power. This is a very good phrase. The whole argument, indeed, is vigorous and strong.

The house community (chapter viii.) is the next stage in sociological development. Then comes the village community, and lastly the manor. "Nor is it possible for me to doubt that the typical manor arose out of the village community." Our author makes this statement on p. 331. The inquiry suggests itself: Why should not the patriarchal family take the form of the manor, and why should not the village community grow up within the manor? Had we space, we should like to discuss this matter at length. Sir Henry Maine does not sufficiently consider the fact that the patriarchal family includes, usually, an assemblage of dependents and slaves. Why not derive the manor, with its tenures and its customs, out of this group, and the village community out of the manor?

The last three chapters of the book (ix., x., xi.) are devoted to the decay of feudal property in France and England, to classifications of property, and to classifications of legal rules. We regret that we have not space to speak more particularly of their contents. On the

whole, the book is singularly interesting, and well worth reading. We may be able hereafter to notice more in detail, and discuss more fully, some of the themes which Sir Henry Maine has made so attractive.

REPORT OF THE UNITED STATES ENTOMOLOGIST.

Report of the entomologist (of the department of agriculture) for the fiscal year ending June 30, 1882. By C. V. Riley. Washington, *Government printing-office*, 1882. 167 p., 20 pl. 8°.

The report before us, which is extracted from the annual report of the department of agriculture, is not only the most voluminous contribution to economic entomology of the year just closed, but it presents the results of the most extensive investigations in this field during that period. The author, an entomologist of unusual ability and experience, was aided by a corps of very efficient assistants, and had at his disposal a large appropriation. This combination could not fail to produce important results.

It is to be regretted that the report reflects the character of too many other public documents, in that much is printed which has not the slightest permanent value; letters, for instance, from correspondents, often in full, which could have been advantageously reduced to half their extent; or accounts like that of the invasion of the army-worm in New Jersey, which is pleasant reading enough, and well suited to a popular journal, but out of place here in the form in which it is cast. Very different from these are the portions written by the entomologist and the members of his staff: these are direct, and to the point.

As the volume containing this report may be had for the asking, it will be in the possession of all who are especially interested in economic entomology. On this account, it is not worth while to refer, in this place, to each of the many topics discussed. A few of them are of general interest.

The circular which accompanied the seeds of Pyrethrum, that were distributed by the commissioner of agriculture, is reprinted, and is illustrated by two excellent colored plates representing the flowers and leaves of P. roseum and P. cinerariaefolium. The circular gives a *résumé* of what is known respecting the history of Pyrethrum, the method of preparing the powder, and the modes of using it. Dr. Riley adds reports from persons to whom seeds were distributed. Only a few persons succeeded in raising good plants. These were chiefly in the north. The failures were probably largely due to drought and bad seed. A report of experiments with the powder, by Miss Murtfeldt, is also given.

Acting under the direction of Dr. Riley, Mr. Hubbard experimented upon scale-insects with various insecticides, and especially with emulsions of kerosene and milk. These emulsions were the most efficient of the substances used.

Several insects infesting the rice-plant are described. The rice-grub is the larva of a beetle (Chalepus trachypygus). This insect feeds upon the roots of rice, and has done considerable damage to rice-plantations. Howard states that the larvae and adults are both destroyed by the 'harvest-water;' and consequently the breeding-places must be those fields which are not flooded, and the patches of volunteer rice. Therefore the insect can be easily kept in check, except where upland rice is grown. The rice-stalk borer (Chilo oryzaeellus) is a new lepidopterous insect described by Riley. The habits of the larva, which are indicated by the popular name, are reported by Howard.

Economic entomologists will note with especial interest the discovery of the larva of the 'corn bill-bug' (Sphenophorus robustus). This larva infests the stalks of corn at or near the surface of the ground. If, as is now supposed, the adult beetle hibernates in the stalk, ploughing up the stubble, and burning it, will be a simple remedy.

'The smaller corn-stalk borer' (Pempelia lignosella) is a new corn-pest which is very destructive in the Carolinas and Georgia.

In an article on the cotton-worm, a machine for spraying the cotton-plant from below is described, and illustrated by a full-page figure.

Embodied in this report is a part of a report on miscellaneous insects, made by Prof. J. H. Comstock to the commissioner of agriculture; the most interesting portion relates to lac insects, of which two species are described from Mexico and the adjoining portion of the United States.

MACGREGOR'S BALUTCHISTAN.

Wanderings in Balochistan. By Sir C. M. MacGregor. London, *Allen & Co.*, 1882. 315 p., illustr. 8°.

This is a rather loosely written narrative — with a tendency to slang expressions, such as 'green funk,' 'make tracks' — of a reconnaissance expedition undertaken in 1876–77, in company with Capt. R. B. Lockwood, who,

unhappily, died shortly after the end of the journey from the effects of exposure. There is a provoking lack of appreciation of geographical form, and a want of understanding of geological structure, that deprives the observations of much value; and the pen-drawings that illustrate the book in good number are extremely rough. Perseverance and energy are, however, apparent enough in the success of the expedition; and the itinerary notes as to roads, supplies, and water, have a great value for those who may have to repeat the author's journey in this desert country. The party entered from the southern coast at Gwadar; and, after traversing for some two hundred miles a barren region of flat valleys or plains abruptly broken by mountain ranges, they reached the desert interior basin, into whose depressions the Mashkel flows from the south; the Halmand and others, from the north-east and north; and several smaller temporary streams, from the surrounding or dividing ranges, forming salt plains or marshes (hamun) at the lowest points. This district is absolutely barren, and very flat, broken only by sand-ridges, or occasional rocky peaks that rise like islands over the level plain. The largest central depression, known as the God-i-zirreh, is a dry salt waste about seventy miles long east and west, and twenty miles wide, surrounded by a barren sandy desert; and the passage across the southern margin of this desolate tract, hitherto unexplored, to a point named Shah Godar, exposed the explorers to great hardships. Water was found there only by digging in the sand of a dry stream-channel (175–185). This was their farthest station; and from it they returned eastward to Jacobabad, in Sind. The people were found avaricious and untrustworthy: their towns were of the most forlorn description. The difficulty of learning local names was not small. The instructions given by a local official to a guide who was to accompany Macgregor were overheard by him: 'This sahib will ask you the name of every hill, every river, and every hut you see.' — 'What for?' — 'Heaven only knows! These sahibs always do that: they ask the name of every thing, and then write it down.' — 'But how am I to name all the hills?' — 'Call them any thing you like, and he will write it.' It seems, that while the people have names for the ravines that they follow, and for the stopping-places on them, they generally have no names for hills and ranges; nor have they any idea of the connection of mountains with each other, or of any system of drainage. Sand-hills are very numerous on the deserts; and, on the plain north of the Mashkel hamun, a peculiar form was noticed, provoking one of the few pieces of careful description in the book (p. 157). The examples were very numerous, and all closely alike; their form was crescentic, and the largest were sixty feet high at the middle of the curve, descending to the general level at the horns; the outer slope is 30°, and the inner 45° with a still steeper inclination at the outer side of the top of the ridge; they stand on a perfectly level plain, with the curve to the north or windward, and horns to the south. One would 'afford cover enough for a regiment or two.' The author imagines that some obstruction like a bush formed the nucleus about which the sand originally gathered. A sketch-map accompanies the volume; but there is often an unfortunate disagreement in spelling between it and the text. Table of contents and index are lacking.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Strain of an isotropic solid. — Mr. Stearn has given a very brief method for obtaining the expression for the internal energy per unit volume of a strained isotropic solid. — (*Quart. journ. math.*, Feb.) T. C. [967

Elliptic functions. — Mr. Glaisher has given a series of integrals of functions depending upon elliptic functions. The paper is of such a character that it is impossible, in this place, to do more than refer to it. It may, however, be remarked that the set of integrals obtained constitutes a valuable addition to the known elliptic function formulae. A continuation of the investigations may be inferred from the manner in which the author has introduced the present article. — (*Quart. journ. math.*, Feb.) T. C. [968

Spherical triangle. — Professor W. W. Johnson remarks, that in the proof of the addition theorem in elliptic functions by means of a spherical triangle whose sides are ϕ, ψ, and μ, where $\phi = \mathrm{am}\, u$, $\psi = \mathrm{am}\, v$, $\mu = \mathrm{am}\,(u + v)$, and k is the ratio of the sines of the angles to the sines of the opposite sides, it is usual to state that the angle opposite to the side μ is obtuse, so that its cosine is $-\Delta\mu$, if the other angles are acute, so that their cosines are $\Delta\phi$ and $\Delta\psi$. This may be shown to be a consequence of the assumption that k is less than unity. The present note aims to show that the restriction, $k < 1$, may be removed, in accordance with which $\Delta\mu$ is always positive; proving directly, that, in all cases, the cosine of the angle in question is $-\Delta\mu$. It is further shown, in order to complete the proof, that the triangle from which the formulae are derived is possible for all real values of u and v, as well as k. — (*Quart. journ. math.*, Feb.) T. C. [969

PHYSICS.

Liquefaction of oxygen and nitrogen, and congelation of carbonic disulphide and alcohol. — On boiling ethylen in vacuo, Wroblewski and Olszewski obtained a minimum temperature of −136° C. With the temperatures thus obtained, which were measured with a hydrogen thermometer, experiments were performed on liquefaction and congelation. Under the pressures 26.5, 24.8, and 22.5 atmospheres, oxygen began to liquefy at the temperatures −131.6°, −133.4°, and −135.8°. It formed a colorless and transparent liquid with a well-defined meniscus. Carbonic disulphide congealed at −116°, and melted at −110°; alcohol became a viscous oil at −129°, and solidified at −130.5°; nitrogen formed a colorless liquid with a visible meniscus. — (*Comptes rendus*, xcvi. 1140.) C. F. M. [970

Electricity.

Alleged luminosity of the magnetic field. — Professor W. F. Barrett says, "It is well known that the late Baron von Reichenbach claimed to have discovered a peculiar luminous emanation arising from the poles of a magnet, resembling a faint electric discharge in rarefied air."

Prof. Barrett and several other gentlemen, members of a committee appointed by the Society for psychical research, have been making experiments with a view to proving or disproving the existence of the alleged phenomenon. No member of the committee appears to have been able to see the emanation; but the committee did discover, in some way not detailed, a certain gentleman, Mr. G. A. Smith, and a boy, Fred. Wells, 'an assistant in a baker's shop,' who each appeared able, in a room perfectly dark to other people, to see a faint glow, like a waving cone of light, at either pole of a strong electro-magnet, and to tell, by the appearance or disappearance of this glow, when the current was turned on or off by means of a commutator in charge of several gentlemen in an adjoining room.

Prof. Barrett seems to have taken various precautions to avoid deception, conscious or unconscious, on the part of the principal actors in the affair; but it is to be hoped the committee will not rest from its labors till it has found some means of making the alleged luminosity visible, not merely to bakers' assistants and other more or less irresponsible persons, but to trained scientific observers. — (*Phil. mag.*, April.) E. H. H. [971

ENGINEERING.

Theoretical mechanics. — Mr. George F. Swain presents an article upon the application of the principle of virtual velocities to the determination of the deflection and stresses of frames. An exact method of finding the elastic deflection in any direction of any point of a frame of any kind, due to Lamé, is first explained. The determination of deflection is in itself a problem of small importance. It finds its application, however, in the calculation of the so-called 'statically undetermined' structures, such as the continuous girder, and the arch with fewer than three hinges, where the forces acting depend upon the condition that the deflection of some point in the frame in some particular direction must be a given quantity. These structures are taken up in succession, and the general equations to be used in their calculation are given. Trusses with superfluous bars are next discussed; and a historical account of the literature of the subject closes the article. — (*Journ. Frankl. inst.*, Feb., March, April.) G. L. V. [972

Naval iron vessels. — The advisory board of the navy department reports in favor of fitting up the League Island navy-yard to build the iron and steel ships to be constructed. — (*Bull. iron steel assoc.*, April, 1883.) R. H. T. [973

Forced draught in steamers. — Experiments on the Satellite and Conqueror, reported by R. J. Butler to the Royal institute of naval architects, indicate that forced draught is not advisable on long runs, but that it is useful on runs of less than six hours. For such cases a fan draught is recommended. — (*Engineering*, March.) R. H. T. [974

Hydraulic machine-tools. — Mr. R. H. Tweddell describes to the British institute of civil engineers forms of machine-tools driven by hydraulic pressure. Riveting has long been practised with hydraulic riveters; hydraulic stamps and forging-presses are now made to do good work; machine-tools have been made by Armstrong; and an hydraulic system of power-transmission has been adopted at Penhouet, France. Portable hydraulic machine-tools are found to save greatly in floor-space, and to save power as well. — (*Engineering*, March 23.) R. H. T. [975

CHEMISTRY.

(*General, physical, and inorganic.*)

Borotungstic acids. — D. Klein prepared disodic borotungstate ($14\ WO_3 . B_2O_3 . 2\ Na_2O . 4H_2O + 25\ H_2O$) by adding the required amount of boracic acid to neutral sodic tungstate. Although other salts were prepared from the sodium salt, several attempts to separate the acid in a state of purity were unsuccessful. The mother liquors of the sodic borotungstate contained a sodium salt of tungstoboric acid, which was precipitated as the barium salt by adding baric chloride. This acid, which is comparatively stable, was prepared by treating the barium salt ($9\ WO_3 . B_2O_3 . 2\,BaO + 18\ H_2O$) with dilute sulphuric acid. Tungstoboric acid proves to be a convenient reagent for characterizing the alkaloids and peptones. With even a minute quantity of the salts of quinine, cinchonine, strychnine, morphine, and codeine, it gives a white precipitate. With peptones it behaves like phosphotungstic acid. The author finds that cadmic tungstoborate is well adapted for use in the mechanical separation of the mineralogical elements of rocks in petrography. In the solid form, its specific gravity is 3.28, and a liquid may be obtained from it of any density between 1 and 3.8. At 75°-80° it melts in its water of crystallization, giving a sirupy liquid of sufficient density (3.7) to float garnet or spinel. — (*Ann. chim. phys.*, xxviii. 350.) C. F. M. [976

Action of chlorine on certain metals. — When thoroughly dried chlorine was allowed to remain in contact with Dutch metal, A. Cowper found, that, apparently, no chemical action had taken place at the end of three months. On introducing even a trace of moisture, the chlorine was rapidly absorbed. Zinc and magnesium were not attacked by the gas after it had stood several days in contact with fused calcic chloride. Silver and bismuth were acted on slowly; while tin, antimony, arsenic, and mercury were attacked with the same energy as in the moist gas. In the dried gas, sodium remained untarnished. Potassium, at first bright, became slowly covered with a purple film, probably of the subchloride. — (*Journ. chem. soc.*, ccxliv. 153.) C. F. M. [977

Drying gunpowder magazines. — It having been officially recommended that chloride of *lime* should be used for removing the moisture from magazines, Prof. Munroe held that this was due to a con-

fusion of the terms 'chloride of *lime*' and 'chloride of *calcium*.' He claimed that chloride of *lime* was both inefficient for removing the moisture, and deleterious in its action on the powder. Experiments were made which showed, that, while chloride of *lime* absorbed 30.70 % of water, chloride of *calcium*, exposed under the same conditions, absorbed 60.50 %. Again: two samples of a gunpowder were treated with water. One sample was exposed to the air; the other, for the same time, to the gas liberated from chloride of *lime* by the action of CO_2. In the first, .16 % of sulphur was found as sulphate; in the second, 1.60 % existed as such. — (*U. S. nav. inst.; meeting* May 10.) [978

Purification of drinking-water. — Dr. F. Roeder finds, that from three to six drops of officinal dyalized iron will carry down the solid matter suspended in one litre of muddy water from the Ohio River. About two drops of the reagent are required to clarify water colored with one drop of blood. Albuminoids are removed by dyalized iron; perhaps, also, the other unwholesome organic contamination. For purification on a large scale, ferric chloride and sodium carbonate may be used. The precipitate may be removed by filtration or decantation. — (*Dep. sc. arts Ohio mech. inst; meeting* May 10.) [979

Formation of crystallized vanadates by fusion. — By heating vanadic acid with sodic bromide and a small quantity of baric chloride, A. Ditte obtained baric vanadate, $Ba(VO_3)_2$, in small transparent crystals. Strontic vanadate was prepared by fusion of the acid with sodic bromide and strontic bromide. Vanadates of lead, cadmium, zinc, manganese, and nickel, were formed in the same way. — (*Comptes rendus*, xcvi. 1048.) C. F. M. [980

A compound of phosphoric and silicic oxides. — MM. Hautefeuille and Margollet observed the formation of the compound $P_2O_5SiO_2$ when metaphosphoric acid was heated to fusion, and silicic oxide added to the fused mass. The silica was prepared by decomposing silicic fluoride with water. — (*Comptes rendus*, xcvi. 1052.) C. F. M. [981

Action of carbonic oxide on the vapor of water. — When carbonic oxide was heated with water to 250°–275° in a closed tube, L. Marquenne noted the formation of carbonic dioxide and formic acid in small quantity. From the result of this experiment, the following conclusions were drawn: 1. Carbonic oxide is a stronger reducing agent than hydrogen; 2. Carbonic dioxide is permanent in presence of hydrogen at temperatures below the point of its dissociation; 3. The carbonic dioxide and hydrogen formed during the decomposition of formic acid by heat is the result of a secondary action between carbonic oxide and water. — (*Bull. soc. chim.*, xxxix. 308.) C. F. M. [982

GEOLOGY.

Geology of Buffalo Peaks, Colorado. — These rise in the highest point 13,541 feet above sea-level, and consist of a narrow, curving ridge, with a peak at each end. The upper portion is composed of andesite (hornblendic), and the lower of tufas of various kinds, the whole resting on granite and upturned sedimentary rocks. It is interesting to note that Mr. Emmons states, that, in the present condition of microscopical lithology, the earlier classification of many rocks as trachytic or andesitic are rendered doubtful, and that "many facts already observed by us suggest a doubt whether von Richthofen's classification of volcanic rocks will be found to hold good everywhere in Colorado, and even that many modifications of the relations of the older eruptive rocks, as well as those of tertiary age, may be found necessary." — (*Bull. U. S. geol. surv.*, i. 11.) M. E. W. [983

Thickness of the continental glacier. — T. C. Smock, of the New Jersey geological survey, has examined the vertical distribution of marks of glacial action in northern New Jersey and southern New York, and concludes, from the difference in altitude of closely adjoining drift deposits, bowlders, and scratches, that the ice must have been from two to four hundred feet thick along its southern margin, from Perth Amboy to the Delaware. To determine its surface slope, the Catskill Mountains were studied, and marks of glacial action found up to altitudes varying from 2,500 to 3,250 feet. Above this, the rock outcrops are more precipitous, even on the northern side, and the detritus is local and angular, and hence it is concluded that the ice reached no higher. From these figures, a surface slope southward of less than half a degree, or under thirty feet to a mile, is obtained, and depth sufficient to submerge the Highlands and Shawangunk Mountains of southern New York. — (*Amer. journ. sc.*, xxv. 1883, 339.) W. M. D. [984

Lithology.

Hypersthene-andesite. — Dr. W. Cross's microscopic examination of some of the supposed augitic andesites in rocks from Buffalo Peaks (see **983**) showed that the pyroxenic mineral was of two kinds, hypersthene and an unknown triclinic one, as determined by their optical characters and a chemical analysis of the former. Since a notice of an abstract of his work has already appeared in SCIENCE (see **375**), only some omitted points will be noticed here.

Besides the position of the optic axes, the chief optical distinction between the hypersthene and the augite (?) is the pleochroism of the former, and the absence of it in the latter, according to Rosenbusch and Cross. A hasty examination of some andesitic rocks by the present writer, since this bulletin was seen, has shown that the pleochroic mineral in some of his sections is not orthorhombic; and from his past studies he can testify, that, if pleochroism is to be relied upon at all, then hypersthene is widely distributed in andesitic rocks, both in North and South America, as well as in gold-bearing and other sands. Dr. Cross claims, that, in all but two of the augite andesites described by Zirkel from the Fortieth parallel collection, the predominating pyroxene is the hypersthene. Cross is in doubt whether the triclinic pyroxene is a distinct species, or augite showing anomalous optical action. Following the current classification of the andesitic rocks which groups them according to their pyroxenic constituent (including hornblende and mica), we shall have enstatite, hypersthene, diallage, augite, hornblende, and mica andesites, — six different species, — to say nothing of the many made out of the older and more altered andesitic rocks. It would seem, that, in the pyroxene group, a similar mixed series exists as has been found in the felspars, with three different crystallographic systems; and the same difficulty may be expected in their use in rock classification.

The paper is a well-written and very valuable contribution to the mineralogy of the andesites; and, from the common lithological stand-point, the conclusions drawn appear to be just. The freedom of opinion, accompanied by the rapid change of views since the survey was organized in 1879, as manifested in the recent publications, is a most encouraging and promising sign for the future. — (*Bull. U.S. geol. surv.*, i. 19.) M. E. W. [985

GEOGRAPHY.

(North America.)

The Blue Hills of Massachusetts, near Boston, are roughly mapped by E. G. Chamberlain; and the view from their highest summit, six hundred and thirty-five feet, is described in detail. Among the visible points are Holt's Hill in Andover, and Manomet in Plymouth, each about thirty miles distant; Wachusett, forty-four miles; and Grand Monadnock, sixty-seven and one-half. One hundred and twenty-five villages were identified, and many others were sighted. — (*Appalachia*, iii. 122.) W. M. D. [986

Eastern Cuba. — W. O. Crosby describes the topographic features of eastern Cuba as dependent on the following structural elements: eruptive rocks, making sharp, serrated mountains, of which the Pico de Tarquino exceeds eight thousand feet; these are flanked by ridges of slates and schists, generally of later date, as at least some of the eruptives penetrate them in tongues and dikes; finally, there are coralline limestones in terraces of marked uniformity for considerable distances along the shore. The terraces stand along the northern coast at altitudes of thirty, two hundred to two hundred and fifty, five hundred, and eight hundred feet. The lowest is most distinctly of coral origin, and closely resembles the reef growing in the neighboring sea. Passing up to the older ones, the limestone becomes more distinctly crystalline, and the corals and shells are in great part obliterated; but the resemblance, coupled with the progressive change, serves to show identity of origin. Some of the terraces slope away from their precipitous front toward the mountains, and are hence regarded as old fringing reefs. The highest limestone forms the upper thousand feet of a bold mountain called *el Tunque*, eighteen hundred feet high. The harbors along the present shore are roughly circular openings behind a narrow deep entrance in the outer reef; the streams back of the harbors flow over detrital fillings of their valleys. All these features are taken together as proof of oscillating variations in the level of Cuba, but in which the upward movement has predominated so strongly as to produce an elevation of two thousand feet in post-pliocene time. The great depression at which this irregular elevation began would have reduced the Greater Antilles to a few small rugged islands, and thus account for the absence of large land-animals, which were common enough there in pliocene and earlier times. [It may be suggested that the movements of depression, here supposed to have interrupted the general elevation, would be more fully proved if it were shown that the old reefs could not have grown outward from the shore during times of rest in the island's rising. The comparatively small and recent depression shown by the silted stream-channels does not necessarily imply previous depressions as well.] — (*Appalachia*, iii. 129.) W. M. D. [987

(Africa.)

Flooding the Chottes. — In spite of the discouragement of an adverse report by the French government commission, Commander Roudaire has succeeded, with the aid of M. de Lesseps, in forming a company to furnish the funds for his project, and in December last went with a party of engineers to sound the lowland by borings between the Mediterranean and the Chottes. As far as reported, only sand was found, which promises an easy construction for the canal that is to form '*la mer intérieure Africaine.*' In March M. de Lesseps was to join the party to make plans for the further work. — (*Bull. soc. géogr. Marseille*, 1883, 36.) Later reports announce the return of Mr. de Lesseps with the conviction that the project can be successfully and advantageously carried out. W. M. D. [988

Stanley and de Brazza. — M. Savorgnan de Brazza is well sustained by the French government in his projects of exploration. An appropriation of 1,275,000 francs was voted him recently by the chamber of deputies, — 449 ayes to 3 noes, — and confirmed by the senate; and a part of his expedition, under M. de Lastours, has already sailed from Liverpool. He plans to enter the interior from a point on the coast north of the Kongo, and is convinced that he will find a valley there, crossing the mountainous continental border, that will allow the easy construction of a railroad to his inner stations on the river. The expedition is to have a most peaceful character, and is placed under the patronage of the ministers of foreign affairs and of public instruction; and 65,000 francs are to be devoted to buying gifts for the African chiefs, who are to be conciliated. In the mean time Stanley, who was thought to be in Spain or at Nice regaining his health, has already sailed for the Kongo with 3,000 tons of merchandise, and, according to English despatches, has already advanced well up the river with 230 men brought around the Cape from Zanzibar by Capt. Cambier. — (*Bull. soc. géogr. Marseille*, 1883, 44.) [989

The rights of Portugal. — The claim set up by Savorgnan de Brazza for French possessions on the Kongo, from which the quarrel between him and Stanley resulted, has aroused Portugal to assert her rights in western Africa. An able treatment of the 'Question of the Kongo' has lately been issued in Portuguese and in French by a committee of the Geographical society of Lisbon, in which they claim all the western African coast between lat. 5° 12′ and 18° S., and an extensive but undefined territory inland, in right of discovery, possession, and recognition. Their pamphlet begins with examples of international decisions bearing on the question, and then, with much care, discusses the evidence of discovery from 1464, of possession from a little later date, and of recognition of their rights by other nations, France among the rest. It concludes with a note from Secretary-Gen. Strauch of the International African association, dated Brussels, Oct. 25, 1882, stating, that, as far as he knows, de Brazza had a mission from the French committee of the association, and funds from the French government; while Stanley was in the service of the International committee, and was charged with founding scientific and hospital stations on the Kongo, but not with acquiring territory. — (*Soc. géogr. Lisboa. La question du Zaire. Droits du Portugal*, 1883.) W. M. D. [990

BOTANY.

Exudation of water from leaves. — By an examination of plants in very early morning, Volkens has greatly extended the list of those from which liquid water exudes. He describes the water-pores of 150 species, distributed through 91 genera and 36 families. He appears to have exercised great care to avoid errors from the possible presence of dew upon the leaves. In order to ascertain the amount of water in the stems of the plants exhibiting this phenomenon, he made use of double scissors, by which a piece about half an inch in length could be cut out at one stroke, thus diminishing the chances of affecting the relative amounts of air and water in the part at the moment of separation. By the use of this simple contrivance, he has shown that the amount of air and water in a vigorous plant varies considerably during the day, even when the specimen is kept under uniform exter-

nal conditions. Most of his observations were made upon wild plants in open fields. — (*Ber. des konigl. bot. gartens, Berlin*, 1883.) G. L. G. [991

Pollination of Araceae. — The contrivances which secure crossing in several species of Dracunculus and Arum have been restudied by Arcangeli, who finds the pollinators of D. vulgaris to be scavenger beetles, chiefly species of Dermestes and Saprinus, while D. canariensis is thought to be fertilized by Cetonia and other flower-beetles. On the other hand, D. crinitum and A. italicum depend upon diptera; the former relying on Anthomyia and related genera, while the visitors of the latter are mainly species of Psychoda and Sciara. The characteristic odors of the several species, which serve to attract the particular insects best fitted to carry their pollen, and numerous structural peculiarities utilizing their visits, receive special attention. A few observations on the rise of temperature in the aroid spathe, and a list of references on the subject, are also given. The writer introduces two convenient terms — osmophore (οσμη, φερειν) and anthophore (ανθος, φερειν) — to designate respectively the upper and lower parts of the spadix. — (*Nuov. giorn. bot. ital.*, Jan.) W. T. [992

Anther of Roscoea. — Lynch describes and figures the lever-like stamen of Roscoea purpurea, which, like the similarly hinged anthers of species of Salvia and Calceolaria, is so pivoted as to have the polliniferous end depressed by, and brought in contact with, visiting insects. In this case, however, the flexible style is carried with the moving stamen, so that its stigma receives pollen, previously collected on the back of the insect, at the same time that a new load is being taken. The contrivance has previously been described by Delpino. In this connection, the curious suggestion is made that Salvia Grahami, the flowers of which are closed by the anther-levers, as in S. fulgens, etc., is pollinated by small insects, which, having forced their way into the flower, can escape only by creeping out over the upper end of the lever, where they are dusted with pollen, beside coming in contact with the stigma. The species, however, is apparently ornithophilous. — (*Journ. Linn. soc., bot.*, xix.) W. T. [993

Withdrawal of pollinia in the bee orchis. — That the spontaneous removal of the pollinia from the anther-cells in Ophrys apifera is due to something besides gravity, would appear from the observations of Clark, which, however, do not give a very clear idea of the process. — (*Journ. bot.*) W. T. [994

ZOÖLOGY.

Mollusks.

Snails used for food in Spain. — Kobelt has issued for private circulation a reprint of his journey, 'Nach den säulen des Hercules,' for malacological investigations. Among other interesting matters in this entertaining brochure, we find an account of the snail-market at Valencia, and numerous references to the consumption of these mollusks for food, not only in the Iberian peninsula, but in Morocco and Algeria wherever the south Europeans have colonized. The Spanish do not merely eat the large vine-snail (H. pomatia), which is made use of in South France and Germany, but appear to consume all kinds which are large enough to be worth the trouble of collection, except a few (Helix Gualtieriana, Leucochroa candidissima, and L. baetica) which are reckoned tough and unwholesome. The women who deal in this kind of lenten food are called caracoleras (from *caracole*, a snail), and congregate in a small open square used as a snail-market, cry their wares loudly, and, to convince customers of the good quality of the animals heaped up before them alive in large baskets, crack the shells open with their teeth. Helix alonensis, the serrano or mountain snail, is considered to be the most delicate of all, and comes from the vicinity of the Vega. From Mallorca is imported H. lactea, which is found throughout southern Spain; and in the Valencia market Kobelt also obtained H. Dupoteliana, vermiculata, and aspersa. They were valued at about forty cents a hundred; and, in spite of prejudice, he felt compelled to acknowledge, that, when properly dressed, some of the kinds were really of delicate flavor. They are cooked, shells and all, in a broth with onions; extracted, stewed, and replaced in the shell to be served; or steamed with rice. Strangers rarely partake of these peculiarly Spanish delicacies; which, nevertheless, are so much esteemed by that nation as to be imported for home use, and even exported for the benefit of Spanish colonists in other parts of the Mediterranean. — W. H. D. [995

Extraordinary Eulima. — That indefatigable collector, Henry Hemphill, has recently sent to the National museum, among other treasures of the sea from Florida, two specimens of a Eulima about 2.5 mm. long, which, except when viewed by transmitted light, have a perfectly sooty appearance. This for the genus is something never before known, and more remarkable in that group than a black swan among birds. — W. H. D. [996

Arctic mollusks. — In the year-book of the recently established Tromsö museum, the land and fresh-water mollusks of the arctic regions of Norway are enumerated, with descriptions of several interesting varieties by Miss Bergithe Esmark of Kristiania. The author, whose paper is printed in English, reviews previous catalogues, and enumerates thirty-five species in arctic Norway, twenty-seven in West Finmark, seventeen in Nordland, and fourteen in East Finmark. In Tromsö, in about latitude 70° north, Clausilia bidentata has been found, and also Helix arbustorum. H. pygmaea reaches 70° 20′ north latitude, which exceeds by several degrees its most northern range in Siberia, and probably elsewhere. Our own Zoögenetes harpa, discovered successively in the United States, Kamtchatka, eastern Siberia (Dall), and the Amur region, is now found extending to the shores of the Arctic Ocean at the northern extreme of Europe. Besides the shell-bearing forms, there are also three Limaces; and the Margaritana margaritifera is in some places common, and frequently produces pearls. — W. H. D. [997

North German miocene. — Koenen continues his researches on the fauna of that formation in a paper covering the holostomatous and tectibranchiate gastropods, the cephalopods and pteropods. He describes and figures many new forms. — (*Neues jahrb. min.*, ii. 223.) W. H. D. [998

Worms.

Segmental organs of leeches. — In continuation of the researches of Bourne and Lang, Oscar Schultze has carefully studied the segmental organs in five species of leeches. These structures are long convoluted tubules, presenting at least three divisions, — the terminal duct, which opens exteriorly; the middle piece, containing a simple canal; the inner part, with branching canals. In no case was the canal found to begin with a ciliated funnel, as in many chaetopods. The parts are difficult to unravel because they are much convoluted, and most of the middle and part of the terminal division is covered by the inner division. The beginning of the inner

division is, however, isolated, and does not cover other parts. In Clepsine this free part consists only of a single row of cells joined like beads on a string. The essential peculiarity of these organs is in the perforated gland-cells, of which there are two forms. The simpler form is found in the middle portion of the organ. Each cell is perforated by a lumen, which communicates and is continuous with the lumen of the next cell, so that a single string of cells forms a continuous canal. A more complicated form exists in the middle division, in that the cells are perforated by branching canals, which are continuous from cell to cell. Between these extremes certain intermediate forms have been observed. — (*Arch. mikr. anat.*, xxii. 78.) C. S. M. [999

Pilidium larva. — In the last issue of Studies from the biological laboratory of the Johns Hopkins university, E. B. Wilson describes the pilidium larva of a nemertine. It is helmet-shaped, with the convex side more elevated than usual, and crowned by a small flagellum. The anterior margin of the bell is prolonged into four short arms, behind which is a deep sinus, followed by two arms on each side, the anterior largest of all. The young nemertines are developed in a folded position within the lower and posterior part of the larval envelope, and are distinctly segmented posteriorly. — (*Amer. nat.*, Jan.) C. S. M. [1000

VERTEBRATES.

Direct action of alcohol on the heart. — A paper on the above subject was read by Prof. H. Newell Martin, based on researches carried out by him in conjunction with Mr. L. T. Stevens. The experiments were made on the hearts of dogs, completely isolated from all the rest of the body but the lungs. The pulmonary circuit was intact; but only the coronary system of the heart was left of the systemic circulation. The rest of the greater circulation was carried on through an artificial arterial and venous system. The heart was uniformly supplied with defibrinated dog's blood. The authors found, 1°. That when the blood supplied to the heart contained by volume ½ of 1% of absolute alcohol nearly always, and when it contained ¼ of 1% invariably, the work done by the left ventricle, as measured by the quantity of blood pumped out in a minute against a given resistance, was greatly diminished. 2°. If the alcoholized blood were not supplied too long the heart could be restored by feeding it with pure blood. 3°. The diminution of work was due to an alteration in the physical properties of the cardiac muscle, in consequence of which the organ expanded greatly. At the height of its systole it almost completely filled the pericardium, and during diastole had no room to expand and take in more blood: hence it had little or none to pump out at the next systole. 4°. The contractile power of the ventricle is not at first affected, since, if the pericardium be cut away so as to give the dilated heart plenty of room for its expansion, as much blood is pumped around as if no alcohol were administered. If, however, the alcoholized blood be supplied to the heart for a considerable time, as ten or fifteen minutes, the muscular power of the ventricle is diminished. 5°. Alcohol in the above-named proportions does not affect the rate of beat of the isolated heart. 6°. An experiment made on a total abstainer to whom half an ounce of absolute alcohol, diluted with water, was administered, showed that the drug had no influence on the pulse rate, although the dose was sufficient to cause dizziness in the person experimented upon. — (*Med. chirurg. faculty Maryland; meeting* April 20.) [1001

Reptiles.

Lingual glands of the frog during secretion. — The important discovery of Heidenhain, that the cells of the submaxillary glands undergo visible changes during their secretory activity, has led to numerous investigations on other glands. Among these is Biedermann's research on the lingual glands of frogs. From his prolix and inchoate article we extract the following conclusions: the glands are closely related to the mucous salivaries in character. They are follicular, with their lower ends dilated. The gland-cells have an outer nucleated zone, and an inner granular zone: the former, after the cells are hardened, is stained dark by carmine; in the inner zone, reagents cause the granules to swell, so that the zone becomes hyaline, and, as it does not stain, in sections it appears clear. To call forth the secretion, the glosso-pharyngeus of one side was irritated for from three to five hours; the tongue was then hardened in absolute alcohol; and, in transverse section, the resting glands were seen on one side, the active ones on the other. During secretion the granules are poured forth, and probably converted into mucin; for they are not mucin while *in situ*, because logwood does not stain them. In consequence of the exit of the granules, the cells become narrower (but retain their height), so that the glands are smaller. In the inner zone there is visible only a granular protoplasm, the intercellular walls are less distinct, and the so-called 'stützzellen' can no longer be well seen. No evidence was had to show that there was a production of new cells during secretion, such as Heidenhain has maintained occurs in other glands; nor do any of the cells appear to be destroyed. — (*Sitz.-ber. akad. wiss. Wien*, lxxxvi. iii. 67.) C. S. M. [1002

Maturation and segmentation of the reptilian ovum. — C. F. Sarasin gives a preliminary notice of his researches on this subject. The most important point is the method of development of the yolk elements out of fine granules, and the continuation of this process during segmentation. The destiny of the nucleus was not satisfactorily ascertained, for the nucleus 'disappeared.' The segmentation differs from what has been hitherto observed in meroblastic vertebrates. — (*Biol. centralbl.*, iii. 108.) C. S. M. [1003

Mammals.

(*Man.*)

The lines on the human skin. — The skin is covered by countless fine furrows. Lewinski has studied these, and arrived at the conclusion that they are bends (*knickungen*) produced by the movement of the skin, either over the joints, as at the knuckles, or directly by the muscles. When the cutis is contracted, the epidermis is laid into folds, which disappear again when the skin is stretched: so, as the cutis is stretched in the living skin with its natural attachments, when a piece of skin is cut out, it contracts, and the epidermis is thrown into folds. — (*Virchow's arch.*, xcii. 135.) C. S. M. [1004

Sebaceous glands of the tongue. — Ostmann has counted the sebaceous glands at the root of the tongue in man, and finds that the range in number is about the same in children and in adults, and that they do not increase very much in number with age, and consequently, as the tongue grows, there are fewer and fewer to the square centimetre. In adults the number varied from thirty-four to a hundred and two: the average is sixty-six. In young children the number varied from seventy-four to twenty-eight; average, fifty. — (*Virchow's arch.*, xcii. 119.) C. S. M. [1005

Weight of infants. — Biedert has studied somewhat the weight of sucking children, and gives a few tables of the weight of four children. He especially insists upon the importance, in weighing babies, of selecting a particular time of the day, and recommends two hours after the first feeding in the morning. By weighing twice after a meal, at different intervals, there is shown to be a loss. From a limited number of observations he obtained the following average losses during periods of ten minutes for different ages: first half of the first month, 3.3 grms.; second month, 5.9; third month, 7.7; fourth month, 8.3; fifth month (one child only), 8.1. These are the rates of loss from excretion of all kinds. The other principal point of Biedert's article is, that, with care in weighing, the accidental variations may be nearly all eliminated, leaving only those due to illnesses. In part second the growth of children with minimal nourishment is discussed from a medical stand-point. — (*Jahrb. kinderheilkunde*, xix. 275.) C. S. M. [1006

ANTHROPOLOGY.

Ruins and graves in Greenland. — H. Rink, reviewing the later Danish explorations in Greenland, says that in the southern district of Julianshaab there are about one hundred localities showing old Scandinavian ruins, the largest and most conspicuous containing as many as thirty ruined buildings, consisting of stone walls of houses, shelter-walls, etc.

A number of Eskimo graves have been examined; and it was found, that, where stones were convenient to the dwellings, low mounds were erected. When these were absent, low hillocks, or elevated localities at greater distance, were selected for the burial of the dead. Near Narkerdluk, graves were found on a hill 440 feet high, and these could only be reached by climbing a very steep trail. They are usually single, though frequently two bodies are found in one. The graves are formed by placing stones in the form of a rectangle; and bodies are often found 'doubled up.' In a tomb measuring four feet long, two feet broad, and two feet in height, were found the skulls of thirteen adults and two children. One grave contained two bodies, across and on top of which lay a third. The most remarkable discovery, however, is the existence of apparent cenotaph tombs carefully constructed and covered, and in which the usual number and variety of trinkets were found lying upon the floor or in burial-vessels, but no indications of a body. The author inquires if these tombs can have been erected to the memory of persons who had disappeared mysteriously. — (*Peterm. mitth.*, xxix. iv.) J. W. P. [1007

Researches in Yucatan. — At a meeting of the Société de géographie, M. Désiré Charnay read an account of his recent voyage to Yucatan and the country of the Lacandons. His mission was to study the documents, vases, temples, palaces, and inscriptions, in order to throw light on the age and origin of American civilization. The paper is, to a large extent, historical and geographical, but contains valuable accounts of the ruins of Aké and Chichen-Itza. Interesting descriptions are given of the large and ornate edifices devoted to the national ball-play, which edifices are believed to have been consecrated to the great civilizer, Cuculcan, the same as the Mexican Quetzalcoatl. The chief discovery mentioned is of the ruins of a city on the left bank of the river Usumasinta, in an unclassified region between Guatemala and the two Mexican states of Chiapas and Tabasco. These ruins greatly resemble those of Palenque, and were named Lorillard City in gratitude to Mr. Lorillard of New York, who had generously contributed to the expenses of the expedition. — (*Compte rendu soc. géog.*, no. 21.) J. W. P. [1008

Cossacks. — F. v. Stein furnishes a valuable paper on the history, culture, and distribution of the Cossacks, with a chart showing areas occupied by the several ethnic divisions. — (*Peterm. mittheil.*, no. 71.) J. W. P. [1009

The Solomon-islanders. — Mr. H. B. Guppy has recently visited St. Cristoval in H. M. S. Lark, and gives the results of his studies of the natives. "The average height of a man is about five feet three inches; span of extended arms, four to five inches more than the height of body; both sexes robust and well proportioned, with some exceptions; skin varies from very dark brown to dark copper, the elderly adults being darker skinned than the youth, from causes partly climatic, partly physiological. Some individuals are of a pale, sickly hue, owing to their being covered from head to foot with an inveterate form of body-ringworm,— a scaly skin-eruption which affects in a greater or less degree quite two-fifths of the natives of this part of the group. In its most aggravated condition, this parasitical disease implicates the skin to such a degree that the rapid desiccation and desquamation of the epidermal cells lead to a partial decoloration of the deeper parts of the cuticle. The hair is black, frizzled, and bushy among the younger adults, with a tendency to arrange itself into corkscrew-like spirals among the middle-aged men. Straight-haired natives are sometimes found. Hairiness varies much with individuals, but the surfaces of the body and limbs are generally free from hair. Skull, mesocephalic; index from .73 to .83, mean between .74 to .77; facial angle 85° to 90°; nose straight, coarse, short, with wide nostrils and depressed bridge." — (*Nature*, April 26.) J. W. P. [1010

American bibliography. — Dr. Daniel G. Brinton thus calls attention to a work by Don Diego Barros Arana, published last summer in Santiago de Chile, entitled "Bibliography of anonymous and pseudonymous works on the history, geography, and literature of America." "The compiler is an expert bibliographer, and, in this quarto volume of 171 pages, traces to their authors 507 books on America, published anonymously or under false names. Their dates of issue vary all the way from 1493 to the Centennial exhibition in 1876. Señor Arana adds very instructive and often copious notes on the writers of these productions, and on their value or lack of value." Mr. Brinton adds further notes on the catalogues of Messrs. Robert Clarke, Henry Harrisse, Felix C. Y. Lobron, Joseph Labin, James C. Pilling, Julius Platzmann, and C. H. Berendt. — (*Proc. numism. antiq. soc. Philad.*, April 5.) O. T. M. [1011

EGYPTOLOGY.

Pithom. — In letters under dates March 12, 18, and 26, M. Naville tells of further discoveries at Pithom. The name of the nome in which Pithom is situated is found to be An; this was placed too far south by Brugsch. The following are part of the treasures from Pithom: a seated statue, in black granite, of the high priest of Succoth; a fragment bearing the two cartouches of Ramses II., and the name Succoth; a tablet of black stone with the inscription recording "the foundation of the city of Arsinoë, at some distance from Pithom, by King Ptolemy Philadelphus. The day before, the workmen had found the base of a standing statue with two cartouches, one giving

the name of Arsinoë, but the other quite unknown. I could not make out to whom it referred, but the next day I saw quite clearly. The top of the tablet is occupied by two series of offerings made to the gods of the Heroöpolite nome by the King Ptolemy Philadelphus. Among the gods is his sister, and wife Arsinoë, with the two cartouches, num ab en shu, mer neteru; Arsina. Below are twenty-eight lines of text, written clearly at the beginning and end of the stele, but, unfortunately, very carelessly in the middle. However, the monument is perfect: there is not one sign wanting. It is one metre and a quarter high, and about one metre wide. . . . One thing interested me particularly in the inscription: it is the name of a locality of which Osiris is the god, and which is called Pi-Keheret. Now, I cannot help thinking that we have at last got the Egyptian name for Pi-hahiroth, and (this conjecture, perhaps, is a little presumptuous) that it was called by the Greeks φαγρωριόπολις. This name of Pi-Keheret occurs twice in the text, perhaps oftener, — once in the offering scenes, and another time in the course of the narration. You will understand how important it would be to gain the site of this spot; and that the mere fact of its being in the Heroöpolite nome, in the neighborhood of Succoth and Arsinoë, would definitely put aside Schleiden's and Brugsch's theory of the exodus through Lake Serbonis."

M. Naville is about to publish a narration of the whole work at Pithom, in which he will fully discuss the many interesting questions which have sprung from that work. — (*Academy*, April 7.) H. O. [1012

PHYSIOLOGICAL PSYCHOLOGY.

Children's minds. — In October, 1869, the pedagogical society of Berlin inquired by circular how many of the children who entered the primary classes had seen certain common animals, insects and plants, public buildings, museums, parks, suburban pleasure-resorts, etc. Other questions related to the home, farm, natural history, God, Christ, prayer, and many such subjects.

Profiting by this experiment, Mr. G. Stanley Hall, last September, undertook to ascertain the contents of children's minds on entering the Boston primary schools. Much pains was taken to collate such questions as would yield the best results, and to utilize the most skilful kindergarten teachers in putting the questions. Even with all these aids and cautions, the results were often very amusing. Two tables are given by Mr. Hall, setting forth the words, and the per cent of children ignorant of them. The high rate of ignorance is absolutely astonishing. About ninety per cent did not know where their ribs were situated, and seventy-five per cent could not describe an island. Furthermore, those who knew certain facts — for instance, that cheese comes from the cow — apprehended them in the loosest manner, thinking, perhaps, that the cheese is squeezed from the cow as the juice from a lemon. The same ignorance or indefiniteness of knowledge marked the opinions of the majority of the children concerning natural phenomena, natural history, and physical experiments of the simplest kind. The author comes to the following conclusions: 1. Children know next to nothing valuable at the outset of their school life; 2. Children can best be prepared for school by familiarizing them with objects; 3. Teachers should carefully explore children's minds; 4. The concepts that are most common in the children of a given locality are the earliest to be acquired, while the rarer ones are later. — (*Princeton review*, 1883, 259.) J. W. P. [1013

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

Re-arrangement. — The collection illustrative of mammalian osteology, which is in many respects one of the finest in America, is at present undergoing a thorough examination, and will be re-installed for the purposes of exhibition and study. The collection is especially rich in carnivores and cetaceans.

Recent additions. — The French government has presented a complete series of Sèvres porcelains showing the stages of manufacture and the varieties of wares produced. —— The government collections of Washington relics, including the Lewis collection, have been transferred from the Patent office to the museum. —— Messrs. Prang and company of Boston have presented a beautiful collection illustrative of the art of lithography. —— The museum has received from the British museum one of its two stuffed specimens of the Senegal manatee (Trichechus senegalensis), together with a skeleton of the same species. All the recent species of the Sirenians are now represented in the collections.

Notes. — The American pharmaceutical association will hold its session in the lecture-hall of the museum in September. —— The preparators of the museum were severally awarded prizes for specimens of their art displayed at the taxidermists' exhibition held in New York in May.

STATE INSTITUTIONS.

State laboratory of natural history, Normal, Ill.

The fauna of Lake Michigan and the smaller lakes of the north-eastern part of Illinois. — Two weeks were spent by Mr. Forbes and assistants in continued dredging off Chicago for a distance of fourteen miles alongshore, from the harbor to about ten miles out. Animal life here was scanty, except within half a mile of shore. The commonest invertebrate forms were Amnicola limosa, Somatogyrus isogonus, Pleurocera elevatum, Goniobasis livescens, and Sphaerium solidulum, among Mollusca; and Daphnia hyalina, Cyclops Thomasi n. s., Diaptomus sicilis n. s., and Limnocalanus macrurus, among Crustacea. Pontoporeia also occurred occasionally. The most abundant macroscopic plant was Nostoc pruniforme, forming small gelatinous nodules on stones. Vaucheria tuberosa was also not rare.

In order to obtain material for a study of the bottom fauna of the deeper regions of the lake, a trip was made to Grand Traverse Bay in Michigan, a long narrow arm of the lake of extraordinary depth near shore. Here, with the assistance of a steam-tug and a crew of four men, the dredge and trawl were hauled repeatedly in water varying from a depth of thirty to one hundred and two fathoms, and the margins of the bay were searched thoroughly and carefully from a yawl. Numerous specimens of Cottidae were ob-

tained, among them Tauridea spilota, Uranidea gracilis, and several examples of Triglopsis Thompsoni (heretofore found only in the stomachs of fishes). An undescribed variety of Mysis relicta was also very abundant. The commonest copepod was Epischura lacustris, a very peculiar new genus and species. A Nitella was dredged here at a depth of thirty fathoms.

In addition to these operations upon Lake Michigan, ten of the lakes of Lake and McHenry counties were sounded and thoroughly dredged, and full collections made of the plant and animal life of each, from the shore to the deepest water. These lakes were shallow, rarely exceeding a depth of fifty feet; and for purposes of comparison with deeper waters of the same series, Geneva Lake in Wisconsin, having a depth of twenty-three fathoms, was thoroughly searched with dredge and trawl. Later an especially minute and exhaustive study of both the plant and animal life of Cedar Lake was made, not only for the purpose of determining the contents of its waters, but also to afford material for a careful study of the entire system of interactions obtaining among them.

The determination of these collections has but just been commenced, but some general results have already been reached. It was found, that, with the exception of Lake Michigan, the deeper interior portions of these lakes were largely barren of either plant or animal life, probably ninety per cent of their inhabitants being collected within a few rods of the shore. This was apparently due chiefly to the peculiar character of the bottom, which was here a very deep, soft, almost impalpable ooze, consisting of the finest particles of the surface-soil washed in from the adjacent country. No forms peculiar to the deeper water were found in any lake except Michigan. A species of Lumbriculus and larvae of Chironomus were the only bottom animals common in the interior of the smaller lakes (and these occurred equally at all depths), except such as ranged from the surface downward. Larvae of Corethra and many Entomostraca were found in countless numbers at or near the bottom by day, but rose to the surface at night.

PUBLIC AND PRIVATE INSTITUTIONS.

Davenport academy of natural sciences.

Relics from southern mounds. — Observing in SCIENCE, p. 349, a notice of a quantity of astragali of deer, etc., collected from mounds in Ohio, I would call attention to the occurrence of similar objects in southern mounds, with, however, a very interesting peculiarity not mentioned in connection with the Ohio specimens.

We have in the museum of the academy some thirty of those astragali exhumed by Capt. W. P. Hall from mounds in Arkansas, where he has, in several instances, met with a considerable number arranged in a row near a skeleton.

Twenty-two of those we have are ground down at the two ends, forming two faces approximately parallel to each other, and cutting away enough to reduce the bone, as a whole, to something nearly approaching a cubical form; i.e., reducing the length to about equal the width of the bone. In some cases the sides, which are naturally nearly parallel to each other, are ground off a little also, to make them more perfectly flat. The convex side is not ground at all in any of these specimens, nor is the opposite or concave side.

The specimens in this collection must be, some of them, from larger animals than even the elk, — possibly the buffalo, — as they measure from three-fourths of an inch to one and three-fourths in width; and the largest must have been at least three and one-fourth inches long before being subjected to the process of grinding into the desired form. Were they kept as charms, mementos or trophies of the chase perhaps, instruments for gambling? — who will explain? W. H. PRATT.

Cranial deformation. — There are now in the museum thirty-three skulls from the mounds of the lower Mississippi valley, — Tennessee and Arkansas, — of which a considerable number, though not the greater portion, present the peculiarity of an occipito-frontal compression, in several instances so great as to cause the transverse considerably to exceed the longitudinal diameter. Four of these crania give the following measurements in inches: —

Longitudinal diameter .	5.50	Parietal diameter . . .	6.28
" " .	5.35	" " . . .	6.03
" " .	5.68	" " . . .	6.25
" " .	5.96	" " . . .	6.15

while the *normal* form seems to give a length exceeding the breadth by an average of nearly one inch.

All of those so very much compressed are, judging from the condition of the teeth, the heads of young persons, say, from fifteen to twenty-five years. Several of those of older individuals exhibit the same flattening in a less degree, as if partially outgrown after the compression had been discontinued.

In those most flattened, the front especially appears to have been confined by a rigid flat body, as the forehead presents a large surface, which is almost a perfect plane; while the back, where the compressor has been applied, is in some instances slightly concave where the sutures unite.

These skulls are rather thin, and quite well preserved. They are found with the prehistoric pottery; and not unfrequently the very large vessels — fifteen inches or more in diameter — contain one or even two crania, and the other bones of the skeleton.

W. H. PRATT.

Peabody museum of American archaeology, Cambridge, Mass.

Mound explorations in the Little Miami valley, Ohio. — A group of mounds on the estate of Mr. Turner, in Anderson township, was systematically explored last season by Messrs. Putnam and Metz, and a careful survey made by a civil engineer, Mr. Hasbrook. The group embraces 13 mounds and 2 earth-circles, all enclosed by 2 circular embankments, one of them on a hill, and connected with the other by a graded way. The altar-mounds mentioned in SCIENCE, No. 12, were found here. The larger of two mounds within the earthwork on the hill, a plan of which was published by Col. Whittlesey in 1850, proved a most interesting structure, unlike any thing heretofore discovered. It contained a small central tumulus, surrounded by a carefully built stone wall, and covered in by a platform of stones, over which was a mass of clay. On this wall were two depressions, in each of which a body had been laid; and outside the wall, in the surrounding clay, were found several skeletons, one of them lying upon a platform of stones. With these skeletons were found a copper celt, ornaments made of copper and shell, and two large sea-shells. With each of three of the skeletons were a pair of spool-shaped ear-ornaments. The thirteen mounds within the large enclosure differ so much from each other in their structure, that detailed descriptions of each would have to be given, in order to convey a correct idea of this singular and interesting group. Under one of the altar-mounds a large ash-pit, six feet deep, and similar to those in the ancient cemetery at Madisonville, was discovered;

and under another altar-mound were eighteen pits of smaller size, but of similar character. Beneath a small mound containing skeletons was an excavation, six feet wide and twenty-seven inches deep, filled with ashes mixed with animal bones, potsherds, and other objects. This is the first time that pits of this character have been discovered in connection with the mounds; and their presence gives an additional interest to this group. In another mound, containing a human skeleton, a small copper celt was found on the bones of a hand, which is of special interest, as it has a cast of the papillae of the fingers distinctly preserved in the carbonate of copper. Under the centre of one mound was a bed of ashes, in which were three pottery vessels.

Dr. Metz also examined a conical mound on the farm of Mr. Gould, about two miles from Reading, on an elevated and commanding site. The mound was six feet high, and sixty feet in diameter at the base. An earth embankment, three feet high and twenty-two feet wide at its base, encloses the mound, forming a circle about it one hundred and fifty feet in diameter, with an opening thirty-seven feet wide looking to the south-east. The mound was found to be stratified; the outer layer was composed of fifteen inches of very hard yellow clay; under this was a layer, ten inches in thickness, of hard clay, burnt to a brick-red color, and mixed with ashes and charcoal; below this was a stratum fifteen inches in thickness of compact grayish ashes containing pieces of burnt stone; beneath this again ten inches of burnt clay, in which were a small chipped flint and a fragment of burnt bone, which was the only piece of bone found in the mound; beneath this last stratum, and occupying the central portion of the mound, was a conical heap of hard gray earth in which were small flakes of charcoal. This gray earth was so hard that it could only be removed by the use of the pick: it was eight by ten feet in diameter, and twenty-two inches in thickness in the centre. Under this hard mass, and below the natural surface of the clay, were four circular pockets or excavations about four inches apart, each of which was ten inches deep and fourteen inches wide; three of them were filled with a dark pasty substance, which became hard on drying, and the other contained fragments of stone, burnt clay, and earth. The structure of this mound is unusual; and the purpose for which it was erected over the four small holes is at present unknown, adding one more to the problems relating to the mounds, which we can only hope to solve by thoroughly exploring such as have not yet been disturbed.

NOTES AND NEWS.

Since the first pages of this issue were in form, it has been announced that a party for the relief of the observers under Lieut. Greely at Lady Franklin Bay will leave St. Johns, Newfoundland, on one of the steam sealing-vessels belonging at that port, about June 15, probably accompanied by a naval vessel as tender. It will be commanded by Lieut. E. A. Garlington, U.S.A., and composed of twelve men, of whom ten are stated to be old sailors and accustomed to the use of boats. Twenty dogs, native drivers, and a supply of fur clothing, have been secured at Godhavn, Greenland. The party at Lady Franklin Bay will be reached and withdrawn if the state of the ice permits. If not, the relief-party is to be landed on Littleton Island; and, while part of them are engaged in preparing winter quarters, Lieut. Garlington will endeavor to open communication by sledges with Greely's people. In the failure of the first attempt, another will be made in the spring of 1884. It is to be hoped, if Greely is not reached, that an attempt will be made to leave at Cape Hawkes or Cape Sabine, if not the relief-party as a whole, which would be best, at least a boat by which the open water to be anticipated between those points and Littleton Island next year (1884) may be passed by a retreating party, which might well find their own boat unseaworthy after dragging it over many miles of hummocky ice, if, indeed, they did not find themselves obliged to abandon it.

— The schooner Leo is on the point of sailing for Point Barrow to withdraw the signal-service observing party under Lieut. Ray, in compliance with the act passed by the last Congress. To utilize the opportunity, Mr. Marr of the U. S. coast-survey will accompany the vessel with the design of making absolute magnetic determinations, of fixing the astronomical position of the station, and of making pendulum observations.

— In 1880 the French minister of public instruction appointed a commission to investigate the zoölogy and physical features of the deep sea under the direction of M. Alphonse Milne-Edwards. It carried on its investigations that year principally in the Bay of Biscay; in 1881, in the Mediterranean; and, in 1882, in the Atlantic as far as the Canaries. This year it will push its researches farther in the Atlantic as far as the region opposite the coast of Senegal and in the Sargasso Sea. The present commission is composed of Professor Alphonse Milne-Edwards, president; the Marquis de Folins; Professors Léon Vaillant and Edmond Perrier, of the Paris museum; M. Fischer, aide-naturaliste at the same establishment; and Professors Marion of Marseilles and Filhol of Toulouse; MM. Charles Brongniart and Henry Villaine, of Paris, are also attached to the commission as 'membres adjoints.'

— By the programme for the summer meeting of the American institute of mining engineers, the opening session will be held in Roanoke, Va., on June 4. A visit to Lynchburg will be made on June 5. On arrival at Lynchburg, a train will take the party to the iron-mines on the James River, at Riverville, and, if time allows, also to Stapleton. In the afternoon a session of the institute will be held. Return to Roanoke in the evening. On June 6 there are to be local excursions around Roanoke, visiting the Crozer furnace, Upland and Houston mines, Rorer iron company's mines, and the Roanoke machine-works; evening session. June 7, excursion to Pocahontas (Flat Top coal-fields), and the Southwest Virginia improvement company's coal-mines and coke-ovens. Returning, the Ripplemead mines

and Bertha zinc-works will be visited. The night will be spent at Abingdon or Wytheville. June 8, excursion to the Cranberry magnetic iron-ore mines in East Tennessee, returning to Roanoke in the evening.

On returning home, members can stop at the Natural Bridge and the Caves of Luray. Those wishing to visit the Cripple Creek ore region can do so by remaining after the close of the meeting. The Shenandoah Valley and the Norfolk and Western railroads have generously offered free transportation to members and the ladies of their families over their lines to and from Roanoke, and also for the excursions of the meeting. The local committees of arrangements are, in Roanoke, J. H. Bramwell, chairman; J. H. Sykes, secretary; Dr. F. Sorrell; Frank Maddock; Major Andrew Lewis; J. Allan Watts; in Lynchburg, Capt. C. M. Blackford, chairman; John H. Flood; George M. Jones; P. J. Otey; W. B. Robinson; T. B. Deane; C. W. Button; T. D. Davis; H. Grey Latham; Alex McDonald; L. S. Marye; John Stevenson, jun.

— An enterprising railroad in Ohio, the Cleveland, Akron, and Columbus railway, has made a new departure in its time-tables by adopting a system which has been approved of, but not ventured upon by many railway companies in the country. On its time-cards the hours are numbered from one up to twenty-four, the latter being midnight. The confusion which so often exists between the A.M. and P.M. hours is thus avoided. Thus one train arrives in Cleveland at 19.30, and one departs from Columbus at 17 o'clock. This road also carries upon its morning trains weather-signals, devised and set by the Ohio meteorological bureau, from predictions furnished by the United States weather-service. It is believed to be the first railroad in the country, if not in the world, to adopt either of these schemes.

— In the Missionary herald for November, 1882, Dr. Nichols wrote from Bailunda, West-central Africa, June 26, "There has been a notable comet hanging in the sky near Venus for weeks; but the natives, so far from feeling any superstitious dread, seem utterly indifferent to it." After this was published, Gen. Hazen, of the Signal-service at Washington, wrote to the Missionary house, inquiring about the letter of Dr. Nichols. Gen. Hazen thought the writer must have been mistaken, as this would be, he thought, the earliest announcement of the comet. He suggested that perhaps the zodiacal light had been mistaken for a comet. By the next mail, Dr. Nichols's attention was called to this; and in a letter received April 22, dated Bailunda, Jan. 25, to Dr. Means of the Missionary house, he writes, "Be certain that that comet of ours was a veritable one, and not a zodiacal light. There was a small but well-defined nucleus, and its motions amongst the constellations were watched by all here."

— Interesting investigations have been carried on during the past year by the agricultural experiment-station recently established in connection with the chemical department of Cornell university. The work done includes experiments on fodders, ensilage, and analysis of agricultural products, the results of which have been collected in the annual report now in press. The analyses were made by the chemist of the station, under the direction of Professor Caldwell, who, in conjunction with the professor of agriculture, superintended the experiments on feeding and ensilage.

— S. Philipp has lately published a philosophical work on the ego of organisms, and the origin of life in unorganized matter, which, together with the cognate writings of Montgomery, are briefly noticed in the *Biologisches centralblatt* for April 1. Those sceptical as to the value of such lucubrations will attribute a meaning to the date in this connection.

— Professor Targioni Tozzetti has just published a report on *Ortotteri agrari*, under the direction of the Italian department of agriculture, industry, and commerce. The introduction relates chiefly to the external anatomy of Orthoptera. In the classification of the order, Professor Tozzetti uses the term 'Orthoptera' in its widest sense, and divides the order into the following suborders: 1. Tisanuri; 2. Ortotteri veri; 3. Corrodenti (Psocidae and Termitidae); 4. Ortotteri amfibiotica (the rest of the Pseudoneuroptera). After treating of the migrating locusts (cavalette) of all countries, and the means for their destruction, a third part gives short instructions how to prevent and counteract the ravages of the Italian species of Acrididae. This seems to be intended for separate distribution among farmers, as the illustrations are repeated from the first part of the volume. A collection of the locust laws made in Italy (beginning with the Mandate from the 'consules agriculturae,' dated April 27, 1654), France, and Spain, and the collected citations from ancient authors relative to Orthoptera, appear in appendices.

The report contains much interesting matter, and will, no doubt, prove useful to the Italian agriculturist; but in its economic and natural history parts it is a mere compilation from other sources, and bears evidence, we regret to say, of hasty work, such as we should not expect from its author. We notice many inaccuracies and typographical blunders, and the figures are for the most part at second hand and poorly copied.

— Some vine-cuttings from Madeira, recently received at New York, caused no little consternation on the supposition that they were infested with Phylloxera. Samples were referred for examination to Dr. J. P. Battershall, who, after microscopic examination, was unable to detect the presence of Phylloxera, but concluded that the vines looked suspicious. Samples were finally sent to the department of agriculture, and submitted to Professor Riley, who found no trace of Phylloxera, and who recommended that the cut-

tings be forwarded for the following reasons: 1. The cuttings came from an uninfested district, so far as known; 2. The insect could only be found at this season on such cuttings in the winter-egg, which, even in countries where the Phylloxera abounds, is extremely rare; 3. Did the cuttings come from a country badly infested with Phylloxera, the danger of the introduction of the pest upon them would be very slight, as the natural history of the insect shows; 4. Even were it possible to introduce the insect with the cuttings, no harm could result, so long as they were sent to any part of the United States east of the Rocky Mountains, since the insect is indigenous here. Were the cuttings known to be infested then, and then only, Professor Riley thinks that prudence would dictate that they should not be sent to the Pacific states, or those portions where the Phylloxera does not now exist.

— Those who have resided a short time in the low pine regions of the Atlantic coast, from Virginia to Carolina, are familiar with the word 'tuckahoe.' The term is a very old one, found in Smith's History of Virginia as 'tockawhoughe,' and in other old writers under different spellings. Professor Gore, of the Columbian university, has been investigating the subject, and has brought to light many important facts relative to it, which appear in the Smithsonian report for 1881. The word has been made to apply to almost every tuberous root and subterraneous fungus which the aborigines were supposed to have used as food. The qualities of all these substances have gradually come together, and by tradition have settled upon one that has little or no value as food,— the Pachyma cocos. This interesting fungus has been analyzed by several chemists, Dr. Torrey among the number, and finally by Dr. Parsons of the department of agriculture. The most notable peculiarities are the entire absence of starch, the small amount of extracted solvents, the gelatinous character of the cellulose, and the very small amount of albuminous substance. The fungus resembles a large yam, with a rough, blackish exterior, and a white, cream-colored interior, very soft when first found, and becoming hard and ivory-like when thoroughly dry.

— The International African association was formed in Brussels in 1876, with an executive committee consisting of the King of Belgium, Dr. Nachtigal, De Quatrefages, and Sir Bartle Frere, the latter being replaced on his departure for the Cape of Good Hope by Mr. Sanford. In the first year of its existence, Belgium alone furnished half a million francs, and the remaining branch societies in other countries about a hundred thousand francs, towards the expenses of exploration. In June, 1877, a commission of delegates from all parts of Europe laid out a plan of work, deciding to begin the establishment of stations between Zanzibar and Tanganyika, of which Karema, five hundred miles from the coast, was the first. A small steamer was placed on the lake. Other stations in the same region were later undertaken by different branches of the association. In November, 1878, a '*Comité d'études du Haut-Congo*' was formed, with a capital of one million francs. This was essentially a subdivision or a new form of the old society; and its first work was to send Stanley to the Kongo at the end of 1879, where he spent two years in constructing a road along the unnavigable part of the river. The funds of the committee are exhausted, and contributions are asked for to continue the work thus begun.

— The April number of the *Johns Hopkins university circular* contains abstracts of many of the recent papers published by members of the university. Under the heading of 'correspondence' are several letters to Professor Sylvester. As a foot-note to one of these, Professor Sylvester remarks, that the last few months will be a period forever memorable in the records of mathematical science as one in which came to light the three great discoveries of a proof being possible of the impossibility of the quadrature of the circle, the existence of an assymptotic value to the sum of the logarithms of the inferior primes to a given number, and the falsity of the ordinarily assumed postulate in the theory of invariants.

— Mr. Robert Ridgway is engaged in a field-examination of the avi-fauna of Illinois and Indiana.

— Dr. R. W. Shufeldt, U.S.N., on duty at New Orleans, La., is engaged in the study of the zoölogy and archeology of southern Louisiana. He has already made very extensive collections of the reptiles and birds of that region.

— In view of the proposed meeting of the British association for the advancement of science in Montreal in 1884, a committee, consisting of Messrs. H. Carvill Lewis, Edward D. Cope, Persifor Frazer, Angelo Heilprin, and Henry C. McCook, has been appointed by the Academy of natural sciences of Philadelphia to secure the co-operation of other societies and institutions of the city in extending an invitation to the American association for the advancement of science, to meet in Philadelphia the same year, directly after the Montreal meeting, so as to increase the facilities for communication with the representatives of the British association. Similar action has been taken by the American philosophical society and the Franklin institute; and the University of Pennsylvania has offered the use of its halls for the meetings.

— It is now stated that as many as four hundred members of the British association have signified their wish to attend the meeting in Montreal in 1884. The local committee at Montreal has decided to suggest the week beginning on Aug. 27 as the most suitable for the meeting.

— A circular has been issued by the Forestry division, department of agriculture, calling attention to

the interest now taken in planting trees in school-grounds, and giving information as to where to plant, what should be planted, and when to plant. It is suggested that the formation of arboretums is desirable, and that collections at the schools, of the native woods of the locality, might increase the interest of the scholars.

RECENT BOOKS AND PAMPHLETS.

Absterbeordnung, Ausgeglichene, mortalitätstafel u. tafel der lebenserwartung f. d. gesammtbevölkerung d. Preuss. staates. Berechnet aus d. mittelwerthen d. preuss. sterbetafeln f. d. j. 1867, 1868, 1872, 1875, 1876, u. 1877. Berlin, 1883. f°.

Album schweizerischer rindvieh-rassen. 20 Photographien. Luzern, 1883. f°.

American museum of natural history (Central Park, N.Y.). The fourteenth annual report. N.Y., *Martin pr.*, 1883. 38 p. 8°.

Amerika's nordwestküste. Neueste ergebnisse ethnologischer reisen. Aus den sammlungen der Königl. museen zu Berlin. Herag. v. d. direction d. ethnolog. abtheilung. Berlin, 1883. Illustr. f°.

Andra, E. Le gélatino bromure d'argent, sa préparation, son emploi, son développement. Paris, *Gauthiers-Villars*, 1883. 77 p. 18°.

Becker, Les arachnides de Belgique. Vol. 1. Attidae Lycosidae, Oxyopidae, Sparassidae et Thomisidae. Bruxelles, 1883. 246 p., illustr. f°.

Bedriaga, J. v. Beiträge zur kenntniss d. amphibien u. reptilien d. fauna von Corsika. Berlin, 1883. 150 p., illustr. 8°.

Behrend, G. Die eismaschinen und ihre verwendung zur kühlung von räumen u. flüssigkeiten. Halle, 1883. Illustr. 8°.

Bovey, H. T. Applied Mechanics. 2 parts. (I. Definitions and general principles as to the strength of materials; The strength and stiffness of beams; Resistance to compression and crushing, etc. II. Frames; Roofs; Bridges; Suspension Bridges, etc.) Montreal, 1883. 8°.

Comité, international des poids et mesures. Sixième rapport aux gouvernements signataires de la convention du mètre sur l'exercice de 1882. Paris, 1883. 52 p. 4°.

Cotteau, E. De Paris au Japon à travers la Sibérie, voyage exécuté du 6 mai au 7 août 1881. Par Edmond Cotteau, chargé d'une mission scientifique. Paris, *Hachette*, 1883. 456 p., illustré. 18°.

Eder, Josef Maria. Ausführliches handbuch der photographie. Mit 600 holzschnitten und 6 tafeln. Heft 1–5. Halle a. S., *Knapp*, 1882–83. 542 p. 8°.

Freyer. Studien zur metaphysik der differentialrechnung. Berlin, *Weber*, 1883. 39 p., 1 pl. 4°.

Ganguillet u. **Kutter**. Versuch zur aufstellung einer neuen allgemeinen formel für die gleichmässige bewegung des wassers in kanälen u. flüssen, gestützt auf die resultate der in Frankreich vorgenommenen umfangreichen u. sorgfältigen untersuchungen u. der in Nordamerika ausgeführten grossartigen strommessungen. Bern, 1883. 123 p. 8°.

Gerland, E. Licht u. wärme. Leipzig, 1883. 320 p., illustr. 8°.

Gerosa, O. Della propagazione nel regno animale. Parte I. Capodistria, 1883. 50 p. 8°.

Glaser-DeCew, Gustav. Die magnetelektrischen und dynamoelektrischen maschinen und die sogenannten secundärbatterien; mit besonderer rücksicht auf ihre construction. Mit 54 abbildungen. Wien, etc., *Hartleben*, 1883. (Elektro-techn. bibl., i.) 16+263 p. 16°.

Goeze, Edm. Tabellarische übersicht der wichtigsten nutzpflanzen, nach ihrer anwendg. u. geographisch wie systematisch geordnet. Stuttgart, *Enke*, 1883. 8+136 p. 8°.

Gyldén, H. Undersökningar af theorien f. himlakropparnes rörelser. (Du mouvement des corps célestes.) Stockh., 1882. 64 p. 8°.

Hartig, J. Lehrbuch der baumkrankheiten. Berlin, 1882. 11 pl. 8°.

Hauck, W. Ph. Die galvanischen batterien accumulatoren und thermosäulen; eine beschreibung der hydro- und thermoelektrischen stromquellen mit besonderer rücksicht auf die bedürfniss der praxis. Mit 85 abbildungen. Wien, etc., *Hartleben*, 1883. (Elektro-techn. bibl., iv.) 16+320 p. 16°.

Japing, Edward. Die elektrische kraftübertragung und ihre anwendung in der praxis; mit besonderer rücksicht auf die fortleitung und vertheilung des elektrischen stromes. Mit 45 abbildungen. Wien, etc., *Hartleben*, 1883. (Elektro-techn. bibl., ii.) 16+239 p. 16°.

Kötter, Fritz. Über das gleichgewicht biegsamer, unausdehnbarer flächen. Inaug. diss. Berlin, *Meyer & Müller*, 1883. 66 p. 8°.

Ledebur, A. Handbuch der eisenhüttenkunde. Abth. 1. Leipzig, 1883. 287 p., illustr. 8°.

Lehmann, J. Die entstehung der altkrystallinischen schiefergesteine mit besonderer bezugnahme auf das sächsische Granulitgebirge, Fichtelgebirge u. bairisch-böhmische grenzgebirge. Bonn, 1883. 200 p., illustr. 4°.

Lolling, G. Die bewegungen elektrischer theilchen nach dem Weber'schen grundgesetz der electrodynamik. Halle, 1883. 4°.

Martens, E. v. Die weich- u. schaltiere. Leipzig, 1883. 332 p., illustr. 8°.

Meyer, A. B. Die nephritfrage, kein ethnologisches problem. Vortrag. Berlin, 1883. 24 p. gr. 8°.

Miln, J. Exploration des dolmens de la Pointe et de la nécropole celtique de Mané-Canaplaye près de Saint-Philibert, en Locmariaquer. Vannes, *Luco*, 1883. 12 p., illustr. 8°.

Milne-Edwards, Alphonse. Recueil de figures de crustacés nouveaux ou peu connus. 1ère livr. (Paris), 1883. (3) p., (44) pl. 4°.

Mounier, G. J. D. Leerboek der goniometrie en der vlakke en bolvormige trigonometrie. Utrecht, 1883. 196 p. 8°.

Müller, A. Die ornis der insel Salanga, sowie Beiträge zur ornithologie der halbinsel Malakka. Erlangen, 1883. 96 p. 8°.

Noether, M. Zur grundlegung der theorie der algebraischen raumcurven. Berlin, 1883. 4°.

Oeltjen, H. Die differentialgleichungen für das gleichgewicht der isotropen elastischen platte. Kiel, 1883. 56 p.

Poillon, L. Traité théorique et pratique des pompes et machines à élever les eaux. 2 vols. Paris, 1883. 8°.

Proctor, R. A. Mysteries of time and space. London, *Chatto*, 1883. 410 p., illustr. 8°.

Prollins, Frdr. Beobachtungen über die diatomaceen der umgebung von Jena. Inaug. diss. Jena, *Deistung*, 1882. 111 p. 8°.

Rammelsberg, C. F. Elemente der krystallographie f. chemiker. Berlin, *Hebel*, 1883. 8+208 p., illustr. 8°.

Riquier, Ch. Application de la théorie des formes quadratiques à la discussion des lignes et des surfaces du deuxième ordre. Paris, 1883. 8°.

Saint-Lager. Catalogue des plantes vasculaires de la flore du bassin du Rhône. Lyon, 1883. 886 p., illustr. 8°.

Saladin. Éléments de tissage mécanique. Paris, 1883. Illustr. 4°.

Sammlung paleontologischer abhandlungen. 1 serie, 1 hft. Kassel, *Fischer*, 1883. 29 p., illustr. 4°.

Saurel, J. Éléments de calcul différentiel précédés de la théorie générale des limites. Fasc. 1. Ghent, *impr. Meyer-Van Loo*, 1883. 44 p. 8°.

Schasler. Die farbenwelt. Ein neuer versuch zur erklärung der entstehung der farben sowie ihrer beziehungen zu einander. Abth. 1: Die farben in ihrer beziehung zu einander u. zum auge. Berlin, 1883. 8°.

Schmelck, L. Chemistry of the Norwegian North-Atlantic expedition: 1. On the solid matter in sea-water. 2. On oceanic deposits. Christiania, 1882. 4°.

Schneider, Osk. Naturwissenschaftliche beiträge zur geographie und kulturgeschichte. Dresden, *Bleyl & Kaemmerer*, 1883. 7+276 p., 13 pl. 8°.

Schroeder, J. v., u. C. **Reuss**. Die beschädigung d. vegetation durch rauch und die oberharzer hüttenrauchschäden. Berlin, 1883. 4°.

Siemens, C. W. On the conservation of solar energy: a collection of papers and discussions. London, *Macmillan*, 1883. 118 p., illustr. 8°.

Spectrum Analysis — Report of the committee (Dewar, Williamson, M. Watts, Abney, Stoney, Schuster, a. o.) appointed for the purpose of reporting upon the present state of our knowledge of spectrum analysis. London. 8°.

Thomson, Sir W., and **Tait**, P. G. Treatise on natural philosophy, 1. pt. 2. Cambridge, *Cambridge warehouse*, 1883. 540 p. 8°.

Urbanitzky, Alfred von. Die elektrischen beleuchtungsanlagen mit besonderer berücksichtigung ihrer praktischen ausführen. Wien, etc., *Hartleben*, 1883. (Elektro-techn. bibl., xi.) 16+240 p. 16°.

Wollny, Ewald. Ueber die anwendung der elektricität bei der pflanzen-kultur. München, *Ackermann*, 1883. 37 p., illustr. 8°.

SCIENCE appears every Friday. To insure publication in current week, all matter must reach Cambridge on [illegible] Terms $5.00 a year in United States and Canada; $6.00 a year in International Postal Union. Single copies [illegible] cents. Advertising rates sent on request. Address all correspondence about contents of paper to "Editor of SCIENCE, *Cambridge, Mass.*;" and all business correspondence to Moses King, Publisher, Cambridge, Mass.

Contents of this Number.

Franklin Press: Rand, Avery, & Company, Boston.

FRIDAY, JUNE 8, 1883.

AN ILLUSTRATION OF AN ABUSE.

AFTER having taken special care in the selection of daily papers for quiet reading, it is disheartening to find one of the most conservative and elevated of these making use of methods which are suggestive of the broad prairie and the backwoods. It appears, however, from a recent example, that we cannot feel quite safe in taking up even the dignified *New York evening post*. In the issue of that paper of May 15, there is a notice headed, '*A Thrilling Government Report*.' A careful examination of the matter shows that the sole object of the heading and the notice is to ridicule the report, or, at least, to create merriment at its expense. This is a mode of procedure against which the present writer has already protested in an article entitled 'Science and the newspapers,' and it seems desirable to again call attention to the true nature of the crime against science which is here involved.

The objectionable notice begins thus: "The United States geological survey has just issued its 'Bulletin No. 1,' on the popular subject, 'On hypersthene-andesite, and on triclinic pyroxene in augitic rocks.' These are the conclusions reached: 1. 'An apparently typical augite-andesite from the Buffalo Peaks is found to contain ***hypersthene*** as its chief pyroxenic constituent,'" etc. Other conclusions drawn by the author, and, of course, expressed in technical language, are then quoted, and nothing further is said. The wit, it will be seen, is very simple, depending upon the heading above quoted, and the introduction of the word 'popular' in the introductory sentence. To one who is constantly dealing with scientific matters, or to one who is tolerably familiar with such matters, even though he may have a keen sense of humor, there is nothing particularly funny in this. But probably it does appear funny to those who are totally ignorant of science. Big words are apt to seem funny to those who do not understand them. One has not far to go for fun of that kind. Almost any paper on a special subject will furnish it. A mathematical paper, for example, is richer in material for it than any other. It must be acknowledged, however, that, if the simple quoting of the language of a technical paper is wit, that wit must be of a very low order.

Leaving entirely out of consideration the character of the wit, the questions suggest themselves whether the display of such wit is worth while, and whether the harm done by it does not greatly over-balance the little good that comes from it in the shape of fun.

What we need as much as any thing else in this country, is an increased appreciation of the real value of scientific work. The 'we' is used in the broadest sense. We as a nation need it, and the influence of those in high places should be exerted in such a way as to develop this appreciation. The average man has somehow got the idea that pure science is of no value, and that there is something absurd about the efforts of quiet investigators who spend their lives in dealing with matters which are of no 'practical' importance. This is a state of mind which is very common, and it needs treatment. Now, the proper way to treat it is not to encourage it, but to point out, over and over again, its error. Ridiculing scientific papers tends to encourage the average man in his false notions, and to perpetuate his benighted condition.

The subject is one of more importance than may appear at first sight. Progress in the greatest things is dependent upon attention to the smallest things. If it is desired to improve the state of the public mind in regard to scientific matters, the greatest care should be used in presenting these matters. Above all, let us be extremely cautious about sacrificing science for the sake of humor. We, as a people, are especially susceptible to the influence of humor. It has been said with considerable truth, that there is nothing about which an American will not joke. Every one has known cases in which this tendency to joking has led to a pretty definite form of insanity, than which there is nothing more hopeless. Now,

when the results of scientific investigations are used as a medium for humor, their true objects are, of course, entirely lost sight of, and science is belittled; and, as humor appeals to the greater number the lower its order, it is clear that the kind of humor we are dealing with must appeal to large numbers of those who are in special need of enlightenment.

Scientific investigations are not proper subjects for the display of wit. The object of these investigations is to discover the foundation of all things, — the truth. Let a man once grasp that idea, let him become imbued with it, let him go through the process of intellectual regeneration necessary to enable him fully to appreciate it, and it will henceforth be impossible for him to touch upon the subject of investigation without experiencing feelings which are totally incompatible with ordinary wit. This is the right attitude towards scientific matters. It cannot be brought about all at once, but the day when it shall be the general attitude can be hastened by those who mould public opinion.

Gentlemen of the press, it is your duty to do all in your power to encourage scientific work, and to give the people right ideas concerning it. We cannot expect this from all. There are many among you whose highest ambition it is to secure and construct 'readable' articles at any sacrifice of principle. But surely it is not too much to expect of those who evidently recognize the importance of higher things.

THE DRY- AND WET-BULB HYGROMETER.[1]

It is not my purpose at present to discuss the theories which underlie hygrometric observations, but rather to ascertain if it is possible to obtain uniform and trustworthy results from the simple observation of this instrument. There has been much discussion of late upon this subject, and grave doubts are continually being thrown upon its accuracy.

It is proposed to ascertain, first, the best method of conducting observations, and, second, the accuracy of the results when compared with a fixed standard. The following is a brief statement of the principles upon which the action of this instrument is based: —

"The evaporation of a liquid involves the conversion of sensible into latent heat; and the supply of heat must be drawn from the liquid or from surrounding objects. At some point the amounts of heat subtracted and communicated will be equal, and an invariable temperature of evaporation will result, depending upon the amount of moisture present."

From this invariable temperature we may be able, by suitable formulae, to obtain the hygrometric state of the atmosphere.

It would seem as though a thermometer-bulb, from which moisture is continuously evaporated, ought to give this needed temperature; yet every one who has had occasion to make such observations has encountered great difficulties, and has become satisfied, that as commonly made, though the readings are of the simplest character, yet the results are frequently entirely inaccurate. This is partially shown by an examination of the various directions that have been published from time to time. Regnault, writing in 1845, says, "I prefer thermometers with cylindrical bulbs as more susceptible to the variations of temperature, and because, for the same mass of mercury, they present a much greater surface to the air. The manner of moistening, I find, makes no difference so long as there is an abundance of liquid. If a drop falls from time to time from the extremity of the bulb, I have still observed no sensible difference. The longer or shorter course which the water runs on the cotton wick exercised no perceptible influence." Other authorities may be quoted as follows: —

Bulbs of both thermometers should project an inch and a half to two inches below the scales; and all objects, metallic or otherwise, which can affect the temperature, should be removed.[1]

All authorities mention the necessity of using rain or distilled water, of frequent cleansing of the muslin, and of changing it at intervals of from half a month to three months. The greatest difference of opinion, however, is in relation to observations below freezing, 'under which circumstances,' says Mr. Scott in his

[1] Read before the Philosophical society of Washington, D.C., May 5, 1883, at its 235th meeting.

[1] This is an important matter. I have seen several illustrations of this instrument, showing the scales extending below the thermometer-bulb; and many otherwise accurate thermometers are made with a metallic scale prolonged so as to afford protection to the bulb. In using such a thermometer as a wet bulb, I have found, with the scale, a mean temperature 1.2° higher than without it; the air was still; there was an abundance of moisture, and over 10° difference between the dry and the wet. This is due partly to the heat radiated from so near an approach of metal at least 10° hotter than the wet bulb, and partly to the arrest of evaporation by the scale.

book just issued, 'the dry- and wet-bulb hygrometer fails.' Some of the directions are as follows: —

Wet the muslin with a camel's-hair brush or a sponge fifteen minutes before the observation. The film of ice should be as thin as possible. Remove the muslin, and wet with brush. Wet, by raising a cup and immersing the bulb for a moment, twenty minutes before the reading. Wet some time, say an hour, before the observation. Wet immediately after a reading, and it will be ready for the next. One authority suggests, that, if the air is still, it is well to increase the evaporation by a fan. Regnault has established that no appreciable error is introduced by an air-current as high as five or six metres per second (metres per second may be readily converted into miles per hour by using the factor 2.24). The Italian government, some years ago, introduced an induced air-current in their hygrometric observations.

Relative humidity at 7 A.M., February, 1883.

Deduced from observations of the dry- and wet-bulb hygrometer

	(1) Kendall Green.	(2) Fort Myer.	(3) West Washington.	(4) Naval Observatory.	Residuals. (1)—(2)	(1)—(3)	(1)—(4)
Feb. 1	76	77	76	100	— 1	0	—24
" 2	75	88	80	100	—13	— 5	—25
" 3	87	89	89	91	— 2	— 2	— 4
" 4	88	78	86	96	10	2	— 8
" 5	95	100	94	94	— 5	1	1
" 6	72	61	80	88	11	— 8	—16
" 7	98	100	89	100	— 2	9	— 2
" 8	83	68	76	94	15	7	—11
" 9	88	77	88	93	11	0	— 5
" 10	75	64	70	82	11	5	— 7
" 11	80	100	83	100	—20	— 3	—20
" 12	64	72	53	73	— 8	11	— 9
" 13	88	88	82	82	0	6	6
" 14	85	100	88	94	—15	— 3	— 9
" 15	100	100	89	96	0	11	4
" 16	98	100	100	100	— 2	— 2	— 2
" 17	90	100	100	100	—10	—10	—10
" 18	84	100	100	87	—16	—16	— 3
" 19	80	73	73	94	7	7	—14
" 20	84	83	82	100	1	2	—16
" 21	74	53	62	61	21	12	13
" 22	87	77	78	88	10	9	— 1
" 23	76	60	72	89	16	4	—13
" 24	83	73	69	94	10	14	—11
" 25	78	79	100	100	— 1	—22	—22
" 26	80	60	73	68	20	7	12
" 27	84	70	52	87	14	32	— 3
" 28	81	79	68	100	2	13	—19
Mean for Feb. . .	83	81	80	91	2	3	— 8
" " March .	64	Iowa Circle 72	68	85	— 7	— 4	—21

As an illustration of the varying results obtained by the common method of observing this hygrometer, I have given the preceding table, showing the relative humidity at four stations in Washington. 1. Kendall Green. This station is situated about a mile and a half north-east of the capitol, and has an exposure of thermometers some fifty feet above ground. 2. Fort Myer, situated about three miles west, and has an exposure about forty feet above ground. 3. West Washington, situated about three miles west, with an exposure about thirty feet above ground. 4. Naval observatory, about two miles west, with an exposure four feet above ground.

This table shows an extreme difference of 35% for a single observation. The very high per cent found at the observatory is due in part to the exposure being so near the ground. This suggests an interesting subject for investigation. It has been determined by experiment in Europe, that, with proper precautions, the actual air-temperature is the same, whether measured at five or a hundred feet above ground. Now, if it be found that the lower exposure gives higher percentage of moisture, due to the settling of fog-banks or strata of damp air, it becomes a matter of the highest importance to ascertain the differences in moisture in different strata, and to settle upon some uniform height for all hygrometric observations.

During the past winter, I have made a large number of readings, hoping to remove some of the recognized difficulties in this class of observations. The exposure of the hygrometers was from a north window forty feet above ground. Great care was taken to exclude all heated currents. The temperatures were from 10° to 50° F.

As an example of these observations, I append a table exhibiting two sets of readings taken on Feb. 13, 1883. The air was perfectly still, and the pressure was 30.40″. The readings were made at intervals, as shown in the table, without disturbing the instrument.

Readings of dry- and wet-bulb hygrometer on Feb. 13, 1883.

First set.			Second set.		
Time.	Temperature. Dry.	Wet.	Time.	Temperature. Dry.	Wet.
4.29 A.M.	-	Wetted.	5.37 A.M.	-	Wetted.
4.37 "	31.8°	32.1°	5.47 "	31.5°	32.1°
4.50 "	31.3	31.4	6.4 "	31.8	32.0
5.4 "	31.1	30.8	6.17 "	30.9	30.9
5.14 "	31 0	30.0	6.28 "	31.0	30.4
5.19 "	31.0	29.8	6.36 "	30.9	30.1
5.26 "	31.1	29.4	6.54 "	30.6	28.4
5.29 "	31.0	29.1	7.0 "	31.0	29.4
5.32 "	31.0	29.4			

As the temperature of the wet bulb was rising at the last observation in each case, it is

evident that the ice had entirely evaporated. At the 5.29 reading, Regnault's formula gives a dew-point of 25.3°, and the condensing hygrometer gave at the same time a dew-point 20.4°. In the second set at 6.54, *seventy-seven minutes after wetting*, the dew-points were 24.0° and 19.7° respectively. It will be seen that the length of time required in the last set (seventy-seven minutes) is entirely too great for good results, as in this time the temperature may change several degrees; and there is so great uncertainty in the length of time required, that, to obtain a good result, it would be essential to wet the bulb an hour and a quarter or an hour and a half before the time, and then note the temperature from time to time in order to catch it when it has ceased falling. The above conditions of observation are ordinarily impracticable, and, besides, the final results, showing dew-points about 4.5° higher than the condensing hygrometer, are entirely unsatisfactory.

I have investigated the effect of an induced air-current as a means of effectually removing these and other objections. Experiments were tried with fans, common hand-bellows, and a Casella whirling apparatus. All of these trials showed, that, with a velocity of the air-current ranging from 1.5 to 5 metres per second, the readings of the dry- and wet-bulb hygrometer are nearly identical.

The length of time required to bring down the wet-bulb temperature rarely exceeds two minutes: in only one extreme case did it require thirteen minutes. If it be objected that any form of motor for producing an air-current must necessarily compress the air, and by heating it vitiate the results, it may be said that the compression need be very slight. Experiment shows that the induced current produces, if any thing, a lower temperature, at least in the winter season; and, since the air-current reaches both thermometers, the differential results will not be affected.

The most satisfactory showing of experiments with an induced air-current, however, is that uniform and accurate results may always be obtained at temperatures as low as 10° (which is the limit that has occurred the past winter), as determined by comparison with a Regnault's condensing hygrometer; and undoubtedly the same would be found at temperatures even below 0° F. The simplest motor for the induced current for any exposure, except from a window, is a common fan; another convenient form, and one by far the easier to use, is the hand-bellows. For a window-shelter, the latter can be readily rigged with a pulley and string so as to be operated from within; and this is the form used by myself. I have mentioned above the whirling apparatus of Casella. This, though giving good results, is much more complicated and expensive, and is, moreover, unsuited to a window-shelter. There are manifold other forms of motors, but it is doubtful if they would be any better than those already described.

I have carefully measured the induced air-currents with a Casella air-meter, and have found that a fan making a hundred strokes a minute in one direction, and placed within three or four inches of the meter, gives a velocity of 1.5 metres per second; that a bellows of a litre capacity, making fifty strokes to the minute, at a distance of six inches, gave a velocity of 2 metres per second, while at twelve inches it gave 1.8 metres per second; and that the whirling apparatus easily revolved the thermometers at the rate of 5 metres per second.

The expense of a fan would be nominal; a strong hand-bellows, with all necessary appliances, ought not to cost more than $2.50.

In order to exhibit the advantage to be gained by ventilating this hygrometer, I give the following table, containing observations with it, and, for comparison, those with the condensing hygrometer, as made at seven A.M. during twenty-nine days of March, 1883.

From this table we see that columns 6 and 7, which contain dew-points computed from the ventilated hygrometer, and determined by Regnault's condensing hygrometer, respectively, show a close agreement; the difference of 2.1° between the means being due in part to the formula of reduction used with the dry- and wet-bulb instrument.

Columns 8 and 9 show a mean monthly difference in the relative humidity, by the unventilated and ventilated bulbs, of 10%, and an extreme difference of 26%, for a single observation, in favor of the ventilated.

Since conducting the above investigation, my attention has been called to similar work done by Mr. Sworykin in Russia. The means of fifteen observations, as given by him, are as follows: mean air-temperature, 21.5° F.; relative humidity, unventilated 59%, ventilated 55%; mean velocity of wind during the observations, 11 miles per hour.

The formulae of reduction used in this paper are those determined by Regnault. He himself declared these unsatisfactory; but they are the best we have, and certainly, as my experiments have shown, very superior to the factors of Glaisher. Many very carefully conducted observations at temperatures below 0° F., and at

Hygrometric observations at Iowa Circle, Washington, at 7 A.M., during March, 1883.

	1	2	3	4	5	6	7	8	9	10	11
	Unventilated.		Ventilated.		Dew-point.			Relative humidity.			Velocity.
	Dry.	Wet.	Dry.	Wet.	Unvent'l'd.	Ventilated.	Regnault condensing apparatus.	Un-v'nt'd.	Venti-lated.	8–9	Miles per hour.
								%	%	%	
March 1 .	31.0°	29.1°	30.6°	28.1°	25.3°	23.1°	24.5°	79	73	6	0
" 2 .	45.8	42.3	45.6	41.0	37.3	33.8	34.3	72	64	8	1
" 3 .	37.5	32.5	37.4	32.0	22.0	20.6	18.3	52	49	3	8
" 4 .	31.0	29.3	30.6	26.0	25.9	22.8	17.5	85	71	14	6
" 5 .	19.1	17.0	19.0	16.4	10.5	7.4	2.4	68	59	9	4
" 6 .	31.2	30.3	31.0	29.4	28.5	26.2	25.6	89	82	7	5
" 7 .	40.1	35.2	40.0	35.0	26.4	26.0	23.0	58	57	1	11
" 8 .	16.4	15.0	16.1	14.1	10.4	7.2	1.9	76	67	9	2
" 9 .	21.0	21.0	20.7	19.0	21.0	13.9	15.0	100	74	26	0
" 11 .	34.7	31.1	35.0	30.2	23.8	20.8	22.2	64	55	9	2
" 12 .	29.9	26.1	29.6	25.1	17.3	14.7	11.1	57	51	6	4
" 13 .	35.5	31.9	34.7	30.7	25.1	23.4	19.9	65	63	2	0
" 14 .	40.5	37.1	40.5	36.7	31.3	30.1	27.4	70	66	4	0
" 15 .	51.5	47.9	50.3	46.2	43.7	41.0	41.7	75	71	4	6
" 16 .	23.7	20.4	23.3	19.4	10.9	7.1	4.4	57	48	9	6
" 17 .	31.6	30.9	32.3	29.7	29.5	24.5	17.8	92	71	21	3
" 18 .	37.7	34.9	37.5	33.8	30.6	26.7	27.2	75	64	11	3
" 19 .	46.8	42.0	46.8	40.7	35.0	31.3	31.1	64	55	9	2
" 20 .	27.4	24.4	28.1	24.0	17.4	18.7	10.7	64	53	11	12
" 21 .	22.9	20.8	22.9	19.0	15.5	6.4	0.2	72	47	25	8
" 22 .	23.4	21.6	22.9	20.0	17.2	12.3	7.1	75	62	13	4
" 23 .	33.0	31.0	32.4	29.8	27.0	24.6	22.9	78	72	6	8
" 24 .	24.2	22.0	24.3	21.1	17.2	12.4	10.0	73	58	15	8
" 25 .	30.8	29.2	30.2	28.0	26.0	23.6	22.5	82	75	7	1
" 26 .	36.8	32.9	37.0	31.7	25.6	20.4	21.1	63	50	13	4
" 27 .	39.7	34.7	39.7	34.4	25.4	24.4	25.3	56	53	3	8
" 28 .	33.2	28.1	33.4	27.9	17.0	15.8	13.8	49	46	3	9
" 29 .	35.2	34.9	35.2	33.8	34.3	31.0	32.7	96	84	12	3
" 31 .	36.2	35.1	36.7	34.0	32.9	29.0	30.4	88	73	15	4
Mean . .	32.7	30.0	32.5	28.9	24.5	21.5	19.4	72.2	62.5	9.7	4.6

elevated stations, will be needed before these formulae can be improved.

The following directions may be given as essential to the satisfactory working of the dry- and wet-bulb hygrometer: —

In order to obtain accurate results, an induced air-current from 1.5 to 5 metres per second (3.4 to 11.2 miles per hour) is essential. This is needed even with moderately high wind; as experiment has shown, that, in a double-louvred shelter, with a wind of 12 miles per hour blowing directly through it, a velocity of only 1 to 1.5 miles per hour was recorded in the most favorable spot.

The thermometers should be preferably cylindrical, with the bulb removed an inch or more from the scale; and no metallic substance should be permitted near the wet bulb. The dry thermometer should be kept clean, as dust and grit would cause a deposition of moisture in foggy weather.

The muslin should be fine, and tied smoothly over the bulb. It needs cleaning as often as it appears to be turning yellow. If dust settles upon it, it can be easily cleaned with water.

Clean rain or melted-snow water should be used for wetting. A strip of cotton three-eighths of an inch wide, or a wick, will serve to make connection between the muslin and the reservoir in warm weather. If the air is very dry, this strip will cease acting; and in such case the bulb may be immersed for a moment. It will be found, that if the reservoir is kept full, and the angle of the cotton is not too great, the latter difficulty will seldom be encountered.

If any moisture is seen on the dry thermometer, it should invariably be wiped off.

If the air-temperature approaches freezing, the reservoir should be removed; though the wick may be left, its end being carried up and fastened to the frame in such a way as to permit of immersing the bulb. The water in the reservoir should be kept in the open air until a film of ice forms upon it, the intention being to keep it as near freezing as possible. The bulb should be repeatedly wet by immersion till a coating is formed, the thickness of which should depend on the difference between the dry and wet bulbs and the velocity of the air-motion; i.e., the greater the difference and the velocity, the thicker the coating. There is no difficulty with an induced air-current in obtaining accurate results with a coating 1 mm. in thickness.

If ice is found on the bulb with an air-temperature at or above freezing, it may be evaporated by the air-current, or melted off with water. The former method is preferable if the wet-bulb temperature is below freezing. If, on immersing, a drop is found at the bottom of the bulb, it can be easily removed before it freezes by touching with the edge of the reservoir.

With these precautions, an accurate determination of the moisture in the air may be made; and this must necessarily add to the value of hygrometric observations, which are so important in the study of the progress and development of storms. H. A. HAZEN.

A STUDY OF THE HUMAN TEMPORAL BONE.[1]—III.

THE temporal bone at birth consists of three osseous pieces suturally connected and partially anchylosed, but readily separable. The pieces are named the *squamosal*, *petrosal*, and *tympanal bones*. In some animals they remain permanently distinct, and in others are variously anchylosed. The squamosal and petrosal correspond in the main with the squamous and petrous portions of the temporal as usually described; but the so-called mastoid portion is derived from both the former. The squamosal contributes about one-third to the mastoidea, while the petrosal contributes the remainder.

The *squamosal* is a nearly circular upright plate which joins the petrosal at the *petro-squamosal suture*. This appears internally as a fissure, extending from the notch at the lower border of the squamosal, in front, to the notch at its border behind. Externally it descends from the latter notch to a position just behind the tympanal.

The mastoid portion of the squamosal is proportionately larger than later, and its auditory plate is less distinctly differentiated from the general plane of the bone. Internally it is defined by a shelf on which rests the contiguous border of the tegmen of the petrosal. Below the shelf, the auditory plate exhibits the smooth surface of the scute, which forms the outer boundary of the attic of the tympanum. The cellular portion above and behind forms the outer boundary of the mastoid antrum. The articular surface for the lower jaw is a shallow concavity, with scarcely a distinction of glenoid fossa and articular eminence; and it deviates relatively little from the general plane of the squamosal.

The *petrosal* obscurely displays the labyrinth, already of mature size and bounded by compact walls, embedded in more spongy substance, from which it may be readily excavated. The superior semicircular canal is especially conspicuous, and includes a large recess, which is subsequently obliterated. The tegmen appears as a distinct triangular plate projecting from the petrosal and overlapping the shelf of the squamosal. The tympanic cavity with its attic and the mastoid antrum are well produced, and are of nearly mature size.

The mastoid portion of the petrosal extends behind that of the squamosal, and is commonly partially anchylosed with it. Its upper extremity is notched to a variable degree; and its lower part exhibits a comparatively slight eminence, premonitory of the future conspicuous mastoid process.

The *tympanal*[1] is a horseshoe-like bone, with its ends anchylosed to the auditory plate of the squamosal. From this it slants downward and inward, and is suturally connected along its posterior and lower border with the petrosal. Its inner margin is grooved for the insertion of the tympanic membrane.

In the development of the temporal bone, the squamosal and tympanal are produced from fibro-connective tissue, and the petrosal and styloid process from cartilage. Ossification commences in the squamosal about the close of the second month of embryonic life; a centre appearing at its lower part, and extending upward in the squamous and mastoid portions, and outward in the zygomatic process. The following month, a centre appears in the lower part of the tympanal, and grows into a slender ring, incomplete above. Ossification commences in the petrosal near the middle period of foetal life. Two centres appear, and extend in the walls of the labyrinth. These centres have been appropriately named by Professor Huxley the *prootic* and *opisthotic*. They quickly coalesce to form the labyrinth, by the subsequent continued growth of which the pyramidal and mastoid portions of the petrosal are developed.

The prootic produces all that portion of the petrosal seen within the cranial cavity, except that which is contiguous to, and forms, the jugular fossa. It gives rise to the upper part of the cochlea, including its base and cupola; to the internal auditory meatus, the upper part of the facial canal and its hiatus, the upper part of the oval window, the superior and external semicircular canals, the upper arm of the posterior semicircular canal, and the tympanic tegmen.

The opisthotic produces all the petrosal seen

[1] Concluded from No. 17.

[1] Auditory process, annulus tympanicus.

beneath the cranium. It gives rise to the lower part of the cochlea, the promontory and lower part of the oval window, the round window, the lower arm of the posterior semicircular canal, the lower part of the facial canal, the jugular fossa, the carotid canal, and the floor of the tympanum.

The mastoid portion of the petrosal is produced, subsequent to the complete coalescence of the prootic and opisthotic, by outgrowths from the posterior and external semicircular canals. The outgrowth from the posterior semicircular canal first shows itself externally in the broad plate of cartilage which forms part of the cranial wall between the squamosal, the parietal, and occipital bones. It makes its appearance as an elliptical islet just in advance of the occipital. In this condition it has been viewed by Professor Huxley as a distinct ossific centre, to which he has given the name of the *epiotic*, regarding it as the specially mastoid part of the mastoid portion of the temporal bone. In my preparations, the elliptical islet has appeared as a continuous growth from the most prominent part, outwardly, of the posterior semicircular canal, after the completion of this by the co-ossification of its arms, which spring separately from the prootic and opisthotic. Later, a second element of the mastoid portion of the petrosal, as an outgrowth of the external semicircular canal, makes its appearance as a quadrate islet in the cartilage intervening to the elliptical islet and the squamosal. The two islets quickly unite, and thus together form the mastoid portion of the petrosal; the notch between them, above, still remaining at the upper extremity of the latter, at birth. From the anterior or quadrate islet, the mastoid process is subsequently developed, and not from the supposed epiotic, as has been asserted.

The squamosal and petrosal commonly anchylose in the external portion of the petrosquamosal suture, near the time of birth; and this portion of the suture is usually obliterated during the first or second year subsequently. Sometimes traces of it remain as irregular chinks, and rarely the greater extent or the whole of it may be retained, as represented in the accompanying fig. 3, from one of several similar specimens in the university museum. The suture is observed to descend from the notch at the upper border of the bone to the point of the mastoid process; and it thus indicates that the anterior third of the mastoidea pertains to the squamosal, while the rest alone belongs to the petrosal. The internal portion of the suture, commonly after some years, is but partially obliterated, and frequently remains, to a variable extent, as a fissure defining the tegmen of the petrosal from the inner surface of the squamosal.

The mastoid process, scarcely marked at birth, becomes conspicuous only after a year or two. The mastoid antrum is developed at birth; but the surrounding mastoid cellules undergo but little development until after puberty.

The external auditory meatus is produced after birth. The auditory plate forming its roof is gradually more differentiated from the rest of the squamosal, and its tympanic scute becomes more distinct by the production of spongy substance between it and the roof of the meatus. The floor and sides of the latter are produced from the tympanal ring, which becomes the tympanic plate of the more mature bone. Lateral processes grow outwardly from the ring, expand at the ends, and conjoin to form the auditory process, leaving an aperture in the tympanic plate. The aperture is obliterated about the third or fourth year, but occasionally is retained as an imperfection, closed by fibrous membrane. From growth downward and backward from the tympanal, the vaginal process and posterior extremity of the tympanic plate are produced.

FIG. 3. — Temporal bone, one-half size, exhibiting the outer part of the petrosquamosal suture, permanently retained, and indicating the division of the mastoidea into a squamosal and a petrosal portion.

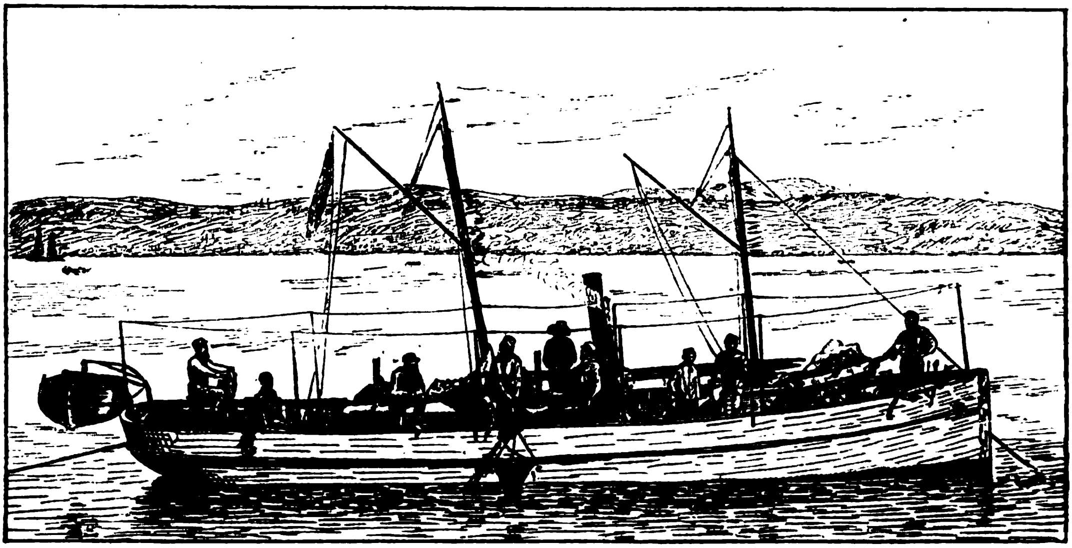
JOSEPH LEIDY.

THE NAPLES ZOÖLOGICAL STATION.[1]

II.

THE fleet of boats belonging to the station, to whose efficient services the constant supply of material is due, consists of two steam-launches and a number of row-boats and sail-boats. The larger of the steamers, named, after the great German biologist, 'Johannes Müller,' was given by the Berlin academy of sciences; while the smaller, the 'Francis Balfour,' was bought by the station. These are used for long excursions, being absent in summer sometimes for three or four days.

[1] Concluded from No. 17.



THE JOHANNES MULLER.

The smaller boats are used for shorter distances and for surface-netting, by which is obtained the heterogeneous collection of large and small pelagic animals known as *auftrieb*, and brought into the station every day in fair weather. A vessel full of the auftrieb is taken to the occupant of each table in order that he may search for free larvae, if he happens to be studying the embryology of animals which leave the egg at an early stage, or may study the many curious pelagic animals which cannot be kept in captivity, and only occur from time to time in the contents of the surface-nets. The larger pelagic animals — such as large medusae and ctenophores — are separated from the auftrieb for the use of those who happen to be specially engaged in their study. But among the many minute creatures which are to be found in it at various times may be mentioned the winged, free, swimming mollusks of the class Pteropoda, known to the Neapolitan fishermen as *farfalle di mare*, or sea-butterflies; the other class of free, swimming mollusks, Heteropods; the free, tailed ascidians, Appendicularia; innumerable species of small medusae, — some adult, some the young stages of the fixed Hydrozoa; and transparent crustaceans of various sizes of the class Copepoda, which are never wanting.

The greatest possible care and attention is given by the attendants, and by the gentlemen of the staff, to the requirements of each zoölogist in the station, with respect to material. If unfavorable weather prevents fishing-operations, or if the animals required are rare, whatever is at hand in the preserved state is placed at the disposal of the investigator; and advice as to methods of preservation and treatment, and information as to the breeding-times and seasons of frequency or rarity of the inhabitants of the gulf, are always offered with the greatest freedom and courtesy. By writing beforehand, a naturalist about to work at the station may insure having material — living and preserved, adult and in the young stages — ready for him on his arrival, so that he can commence his researches at once. But the zoölogist who occupies himself at the station is not merely a passive recipient of the benefits of its organization. Every opportunity is given to him to study its whole working, and to take an active part in the fishing and dredging operations. He is invited to accompany the members of the staff on the steamers on excursions in the bay and to various points on the coast or neighboring islands, — to the Bay of Salerno, to Capri, to Ischia, — in order to see how the different kinds of apparatus are worked, and, if he pleases, to descend, equipped in the diving-dress, and examine the bottom of the sea with his own eyes. The beauty of the scenery and climate, the congenial society, and the interest attaching to the operations, combine to render these excursions the most pleasant events in the course of a visit to the zoölogical station.

A zoölogist obtains the privilege of working at the station by application to some institution

in his own country which has the disposal of a table: in the majority of cases, the application has to be made to the government. The station lets its tables to scientific corporations or to governments at a yearly rental of four hundred dollars each. There are, at present, twenty tables taken, of which the greater number belong to Austria, Germany, Russia, and Italy. Holland and Belgium have one each, and England has two. There is room in the station for thirty. The rapid development of the institution is shown by the fact, that, when it was first opened (in January, 1874), only seven tables were taken. About two hundred and thirty biologists — among them, very many of the highest eminence — have worked in the laboratories of the station in the nine years of its existence; and the published works founded on the studies so carried out form a considerable proportion of the total addition to biological knowledge produced during that period. The brilliant researches of Francis Balfour on the development of elasmobranchs, which formed such a large step in the progress of vertebrate embryology, were carried out chiefly during the time he spent at the table of Cambridge university, in 1874, 1875, and 1877; and he always fully acknowledged the debt he owed to the zoölogical station and its staff. Professor Grenacher commenced his researches on the eyes of arthropods at the station in 1876, — researches which resulted in his classical work, which is, up to the present, the principal authority on the subject. The brothers Oscar and Richard Hertwig carried out their interesting work on the histology of the Actiniae at Naples. F. E. Schultze and Oscar Schmidt, two of the principal living spongiologists, have availed themselves of the resources of the station; and Professor Claus, Dr. Hubrecht, Dr. Spengel, and Dr. Chun are other names whose celebrity in zoölogy is connected with the institution. Last year an American zoölogist, Dr. Whitman, carried out some important researches in the Naples laboratory on the curious parasites, Dicyemidae.

The number of those belonging to the permanent scientific staff of the station is eight, including Mr. Petersen, the engineer, to whose skilful and successful management of the machinery the wonderful regularity and efficiency of all the mechanical arrangements is due. The other seven are biologists who are occupied in the preparation of monographs of various classes, for the series published by the station; while they divide among them the work connected with the issue of the two periodical publications, and the routine duties of the laboratories. Dr. Dohrn acts as director, and represents the station to the outside world; while the chief duties of management devolve on Dr. Eisig, to whose devotion and foresight the enterprise owes much of its success. The duties of librarian are discharged by Dr. Brandt, whose name is well known in connection with the recent discoveries that have been made, as to the existence and significance of symbrosis in animals, and who is engaged at present on the monograph of the radiolarians of the gulf. Dr. Lang, in the

THE DIVER'S BOAT.

course of his work on the turbellarians, has already produced some extremely important papers on their morphology, and the relations of plathelminths generally. The monograph of Dr. Mayer, on the curious crustacean family Caprellidae, has just appeared, and the 'Copepoda' of Dr. Giesbrecht is rapidly approaching completion. To the two zoölogists last named belongs the credit of most of the great improvements in technique which have been invented in the station. The value of these improved methods can scarcely be overestimated. Technical difficulties often stand in

THE STATION FISHERMAN.

the way of the solution of definite and important questions: before them the investigator is brought to a stand-still, and his advance in the desired direction hopelessly blocked. The discovery of a rapid and certain method of obtaining series of sections, which science owes to Dr. Giesbrecht, has given a new power to research, and enabled investigations to be undertaken which before were impossible.

The publications of the station have already been mentioned, but it is well to add a few details concerning them. The monographs are intended to form a series of complete studies of every group of animals existing in the gulf, and to contain a body of accurate information on the anatomy, histology, classification, and relations of marine forms, which shall serve as a sound basis for future investigations. The series includes Algae as well as animals. They may be written in either of the four generally known European languages. Six have already appeared, the first being the beautiful work of Dr. Chun on the Ctenophorae. One by Dr. Emery has already appeared in Italian; and the Actiniae of Dr. Andres will shortly be published in the same language. They are published by subscription, of which the annual amount is $12.50, and the number of subscribers, up to the present, is two hundred and sixty. The station also issues a journal for original memoirs of work done in its laboratories, called the 'Mittheilungen aus der zoologischen station,' which commenced in 1879, and whose three volumes contain already much important work; also a bibliography, called the 'Zoologische jahresbericht,' in which every paper on biological subjects is not only indexed, but summarized. The latter was commenced in 1880.

It will be allowed that the zoölogical station has already a many-sided activity; that it has done, and is doing, a great deal for biological science; nevertheless, it is about to take a still further expansion. A separate laboratory is in course of preparation for the study of comparative physiology, for which nowhere such favorable conditions could be found as will be provided by the resources of the existing station. Every one who is a friend to the progress of biology must wish the Neapolitan station success in its new enterprise, and a continuance of the successful development which has, up to the present, taken place in the original institution.

EMILY A. NUNN.

EVIDENCES OF GLACIATION IN KENTUCKY.

THE following notes of observations on glacial action south of the Ohio River are submitted to the fund of evidence of glaciation anterior to the period of the great terminal moraine.

1. At the crossing of the Kentucky River by the extension of the Kentucky Central R.R., opposite the mouth of Otter Creek, and in Clark County on the north bank of the river, the following fresh section was obtained at the mouth of the railway-tunnel.

	Thickness.
Beneath the surface-soil, yellowish clay, with layers of gravel in the lower portion, and in patches through it	20 ft.
True drift clay, bluish, with smoothed and striated gravel; small bowlders of limestone; one large bowlder of blue limestone of several tons' weight; together with many smaller ones which had been partially removed	5 ft.
Limestone in thin layers to level of railway,	3 to 7 ft.
Above the bed of the river	61 ft.

This locality is sixty miles south from the crossing of the Ohio River by the grand moraine.

2. In Rock Castle County, at the summit of the Knoxville branch of the Louisville and Nashville R.R., between Roundstone Lick and Pine Hill, is a hill of modified drift, mainly composed of detritus derived from lower coal conglomerate and limestone. The railway cutting revealed some twelve feet in thickness of this material.

3. At the crossing of Rock Castle River by the same railway, polished and striated blocks of subcarboniferous limestone *in situ* were seen after removal of the superimposed clays. The striation of these blocks may be due to ice moving down the river, though it is doubtful if river-ice has ever weight enough to do much smoothing and striating work.

4. At the Hazel Patch summit of the same branch railroad, on the highest portion of the Cumberland plateau in Laurel county, a cut of the road revealed a low moraine composed of fragments of carboniferous slates and sandstones, and of the upper coal of this portion of the county. In riding over this plateau two years ago, I encountered this moraine, and then traced it east and west for some distance, suspecting its ice-origin. Subsequent work on the line of the railway confirmed my suspicions.

5. In the summit between Laurel branch of Rock Castle River, and Lynn Camp branch, a heavy bed of glacial clay was encountered, showing the worn-off edges of coal-seams on their northern aspect, and fragments mingled with the clays, similar to coal-beds and clays to be seen almost anywhere in Ohio.

My notes of these two last localities having been mislaid, I cannot describe the sections in detail.

These clay-beds cannot be referred to clays derived from decomposition of shales and marls of the coal strata. The latter are always found *in situ*, while the glacial clays may repose upon coal, sand-rock, limestone, or any other strata of the county, so that there is no danger of confounding the two. If the recent cuts of railways in construction and of those lately completed were closely examined, the surface geology of Kentucky would doubtless reveal many other localities where glaciation could be studied to advantage.

R. P. STEVENS.

EARLY DEVELOPMENT OF REPTILES.

W. F. R. WELDON publishes a valuable article on Lacerta muralis (*Quart. journ. micr. sc.*, xxiii. 134). His clearness and conciseness contrast very agreeably with the prolixity of many embryological writings. At the close of segmentation the ectoderm consists of cells very irregularly arranged, often two layers deep. The entoderm is also irregular and two or three cells thick. The area pellucida is formed by the outer cells becoming more columnar, and the inner cells more regular. Soon the posterior end of the area is marked by the presence of the primitive streak, which is a mass of closely packed cells, exhibiting no division into layers. The blastopore commences at the anterior end of this streak as a pit, open above, closed below. The floor of the pit breaks through, and the blastopore assumes its normal condition, forming a communication between the exterior and the primitive entodermic cavity. The mesoderm arises as two lateral outgrowths from the primitive streak, afterwards from the sides of the blastopore, and the axial strip of invaginated hypoblast. Anteriorly the mesoblastic elements are branched cells, which are budded off from the entoderm. (Do not these correspond to Hertwig's mesenchyma?) Weldon confirms Balfour and Stahl's account of the development of the allantois as a process of the primitive streak.

Having examined younger embryos than Braun, Weldon is able to rectify the former's account of the origin of the Wolffian duct and renal tubules. The protovertebrae are connected by an intermediate cell-mass with the lateral mesoblast. In this intermediate mass there appears a series of cavities, each opposite a protovertebra, and separate from one another. They are the segmental vesicles described by Rathke and other writers. When twelve protovertebrae are present, the Wolffian duct begins to appear as a solid cord of cells, splitting off from the intermediate cell-mass, and passing, therefore, into the dorso-lateral wall of each segmental vesicle. The duct develops, acquiring a lumen in the intervertebral spaces first; but, when there are fifteen protovertebrae, it becomes a continuous canal through the first eight segments, and acquires at the same time communication with each segmental vesicle. Back of the eighth segment the development is similar, except that the duct grows independently of the vesicles. This agrees with Sedgwick's observations on the process in birds and elasmobranchs.

Another paper on this subject has been published by Dr. H. Strahl (*Arch. anat. physiol., anat. abth.*, 1883, 1). As an introduction, he gives notices of previous researches on the same theme. Then follows a chapter of general remarks, in which the gestation, growth, and gross changes of the embryos, and the manner of obtaining them, are considered. The main part of the article is devoted to a detailed account of the new observations, prefaced by a summary of the results previously obtained by himself. The new part begins with the stage when the blastopore or neurenteric canal is completely formed. The principal new results may be summarized as follows: in the neurenteric canal, two

parts may be distinguished, — one vertical, descending from the blastopore; the other horizontal, running forwards. In the dorsal wall of the latter, the chorda dorsalis makes its first appearance. The canal closes at the same time as the medullary tube. Just before the closure of the blastopore, the 'anlage' of the medullary cord extends around it. After the external closure, the communication between the medullary tube and the digestive cavity is still maintained by the canal. Strahl uses the unfortunate term 'medullary cord' to designate the medullary tube, notochord, and part of the primitive streak together: hence he describes the chorda as being differentiated from the medullary cord. This only adds to the confusion, and is the more to be regretted, since the real origin as described by him agrees with the accounts of other writers, — it is at first a modification of the epithelium of the neurenteric canal. The middle portion of the chorda is the first to be grown over by the entoderm: therefore the two ends remain longer uncovered than the middle. At the time when the peripheral mesoderm, forming the area vasculosa, reaches the germ-wall, the latter is already completely fissured. Blood-vessels have begun to appear before this time, and without the participation of the germ-wall. C. S. MINOT.

THE INTERNATIONAL GEOLOGICAL CONGRESS.

THE compte rendu of the second session of this congress, held at Bologna last year, has just appeared in a thick octavo, with abundant illustrations. The history of the congress, forming the first part of the volume, was prepared by the president, Capellini, and consists of a brief account of its origin with the meeting of the American association for the advancement of science in 1876, a summary of the results of the first meeting at Paris in 1878, a list of the members and officers of the first congress, an account of the choice of Bologna as the rendezvous for the second meeting, of the nomination of the international commissions, of the organization of the second congress, with its rules and regulations, and lists of the members, delegates, and officers. In connection with this latter portion, it is curious to note that a number of the more eminent geologists who originally took part in it no longer belong to the congress; and also that the number of Italians at the congress was 202, although the geological society of Italy has only 120 members, of whom 14 are foreigners.

The second part, prepared by Delaire and Fontannes, besides the proceedings at the different sittings, contains a number of appendices on geological coloring and nomenclature, and one on the classification of mineral masses by M. de Chancourtois, accompanied by a tabular view of lithological synthesis. This author objects to the indiscriminate use of the word 'rock,' and proposes instead the word 'lithe,' which he subdivides, according to the origin of the rock, into analithes, endo-analithes or endolithes, exo-analithes or exolithes, catalithes, peri-catalithes or perilithes, apo-catalithes or apolithes. The reports of the discussion are interesting, as showing the extreme difficulty of reaching any unity in classifications, even on the most trifling points.

The third part (documents of the congress, prepared by the same hands) contains a brief description of the collections and maps exhibited at the congress. Among these may be mentioned the geological map of Italy (scale, $\frac{1}{1,111,111}$), engraved in the colors of the international commission, especially for the congress, in two editions, — one with the mountains figured in hachures, and the other without them. The latter is the clearer, and preferable as a geological map. It is curious that a map on a scale so small should have twelve colors devoted to crystalline rocks, and only ten to the sedimentary strata; and it answers well its purpose as a study of geological map-coloring. The Italian committee also prepared a geological and paleontological bibliography of Italy, containing mention of 6,566 memoirs from the days of Aelianus (693 B.C.) to 1881. Its arrangement is remarkably clear and simple.

The fourth part (annexes) contains *in extenso*, and in their original language, the reports sent by the national committees to the international commissions established in 1878. They are followed by summaries of a few individual reports on the unification of nomenclature, or of graphic processes.

The scientific communications are the following: 1°. Macrographical classification of the trachytes of Hungary, by J. Szabó, already mentioned in SCIENCE. 2°. On the classification of the ancient stratified rocks of the island of Sardinia, by J. G. Bornemann, who has found a number of primordial fossils, paradoxides, etc., with intercalation of the second fauna. This would seem to be analogous to the condition of the Taconic of Vermont. 3°. On the cretaceous system and the great sand-dunes of the northern Sahara, by G. Roland. He considers the cretaceous as consisting of the middle and upper divisions; that the sand-dunes constitute distinct chains, formed entirely by the wind, and depending for their orography on topographical accidents; that the larger dunes are not moved by the action of the wind, the position of the masses, and the orography of the chains, varying but little, excepting that, as a mass, they are very slowly travelling toward the south-east, and the quantity of sand is continually increasing. 4°. Memoir on the geology of New South Wales, by C. S. Wilkinson, who recognizes all the great divisions, from the Silurian to the tertiary inclusive, and confirms the truth of the report of the late Rev. W. B. Clarke of the association of triassic plants with the marine carboniferous fauna.

Next follows an account of the three excursions taken by the congress to Florence, Pisa, and Carrara. Accompanying the latter is a section from Carrara to the central region of the Alpi Apuane, in which the Carrara marbles are shown to be of triassic age; fossils of this age being found in, above, and below them.

We next have the prize memoirs on the unification of graphic processes in geological maps. The best was considered to be that by A. Heim; next comes the one by A. Karpinsky, and, lastly, that by M. Maillard. Mr. Heim's memoir contains a plate exhibiting the application of his system to profile sections, which is very clear and plain.

The last or fourth part contains numerous reports on geological nomenclature and coloring of more or less importance. It does not seem to have occurred to the congress to compare the different methods in actual use by the different geological surveys. None of the different reports seems to give these, except that by Major J. W. Powell of the U. S. geological survey. The difficulty, with our still imperfect knowledge of geology, of establishing any system of universal application, seems very great, and is well illustrated by Professor Hébert when he expressed the ingenious wish that votes should only be taken on those points on which all are agreed.

In conclusion, we may mention the very sensible motion of Mr. Torel, that the congress, while leav-

ing to the organization committee of each session the care of detailing its programme, desires that in future a place should be reserved for purely scientific studies, besides the works of unification; and also wishes, that, following the example given at Bologna, an exhibition of collections and maps should accompany each session of the congress. J. B. MARCOU.

DEVELOPMENT OF THE MEMBRANE-BONES OF THE SKULL OF THE PIKE.

IN an inaugural dissertation presented to the faculty of the university of Jena, which has been published separately, and also in the *Jenaische zeitschrift* (xvi. 59–87, 1882),[1] with two excellent plates, Johannes Walther discusses this subject very ably, and reaches the following conclusions, which are probably of considerable importance as leading to important general views respecting the development of the membrane-bones of the skulls of Teleostei.

The skull of the pike (Esox lucius) consists of membrane and cartilage bones. The former develop in the following ways: 1. As cementum-bones, by the coalescence of osseous cementum-plates developed below the bases of the teeth, which are formed in invaginations of the oral mucous membrane; 2. As membrane-bones in the subcutaneous connective tissue, independently of any antecedent development of teeth; 3. As perichondrial bones, like the last, but in a deeper layer in contact with the perichondrium. These three modes of development of the parts of the osseous skull are connected together by transitional modes. According to a fundamental biological law, as well as in view of the evidence afforded by the studies of O. Hertwig in the comparative embryology and anatomy of the scales, dermal scutes, etc., of fishes, the preceding types of osteogenesis constitute a series of stages which correspond to the phylogenetic mode of evolution of the bones in question.

The cartilage-bones of the pike's skull develop outwards from the perichondrium, though there is a centripetal growth of osseous tissue during which the cartilage is absorbed. The origin of bone-corpuscles inside of cartilage, or enchondrally, was not observed in any of the stages investigated. The vomer, palatine, and dentary bones are conspicuous instances of the first-mentioned mode of ectosteal development from the fusion of basal, osseous, tooth-supporting plates, which the author regards as representing the cementum. The maxillary, jugal, frontal, nasal, parietal, and parasphenoid bones, although not ontogenetically developed in this way, are true membrane-bones, and are derivable primarily or phylogenetically from coalesced basal dentary plates.

The author finds an enamel cap surmounting the conical hollow dentinal bodies of the teeth which contain the pulp. The conical dentinal cap is the first part of the tooth to be formed; the enamelled tip is then developed previous to the anchylosis of the whole to the osseous basal plate, the dentine growing downwards to meet the latter.

The paper also contains observations on the development of the teeth of the young trout, California salmon, common salmon of Germany, and the eel. The morphology of the skull of Esox is very fully and admirably treated, the histological details and crania of the larval stages figured and described constituting a real addition to our knowledge.

J. A. RYDER.

[1] See also SCIENCE, ¶ 738.

LETTERS TO THE EDITOR.

Rainbow.

LAST evening I observed what to me was a new phenomenon. The day had been clear. Towards sunset the sky clouded in the west with rain-clouds, so that the sun appeared through them only as a white spot of light. The clouds were continuous, but uniformly lighter from the horizon upwards. At quarter of seven o'clock a rainbow, faint, but still distinct in form and color, was visible above and to the northern side of the sun. It extended, perhaps, something less than two-thirds of the way from the horizon in the north to that in the south. The phenomenon is of course easily understood, but is it common?

W. J. L.

Andover, N.H., May 15, 1883.

Nemestrinidae.

In the notice of Handlirsch's discoveries as to the life-history of Hirmoneura obscura (SCIENCE, p. 332), I stated (following Osten Sacken's catalogue) that Hirmoneura was the only genus of Nemestrinidae in the United States. Dr. Williston kindly reminds me that I overlooked his description of Rhynchocephalus Sackeni from Washington Territory, published in 1880 (*Trans. Conn. acad.*, iv. 243). He now publishes (*Canadian ent.*, April, 1883) a paper on the North-American species of that family, in which he describes from my collection a third species; viz., Rhynchocephalus volaticus from Florida. While speaking of this dipterous family, I would also mention that Baron Osten Sacken (*Wiener ent. zeit.*, ii. 114) calls attention to a short communication by E. L. Arribalzaga, published in *El naturalista Argentino*, i. 275 (1878), on the life-history of Hirmoneura exotica Wied., which oviposits in the galleries of a carpenter-bee (Xylocopa augustii St. Farg.). This last constructs its cells in fence-posts and in the wood-work of buildings. Nothing further is stated by Arribalzaga; but the young larvae doubtless leave the burrows, and otherwise resemble those of H. obscura. C. V. RILEY.

Intelligence of the crow.

In SCIENCE, Nos. 13 and 16, are letters bearing this title, in the former of which the writer refers to crows assaulting him while walking in Rome by attempting to drop stones upon him as they circled above. The author of the second letter takes exceptions to the statement, especially to that part of it averring that the crows dropped the stones *from their claws*, and thinks the narrator must have been 'mistaken in the bird,' basing his belief on his own experience with crows and ravens in confinement, which he has observed always to use their *bills* in transporting objects. Whatever the crows may 'do in Rome,' it is well attested that rooks (Corvus frugilegus), which are true crows, have been seen to carry mussels from the beach to a considerable distance into the air, and let them fall among stones to break the shells, so as to get at the contents. Gulls are well known to occasionally resort to the same practice. Although in neither case do the accounts I have seen state explicitly how the mussels are carried, the inference is that they are taken in the bill. Yet as woodcocks have been seen to transport their young by flying with them supported between the feet, it is obviously unsafe to dogmatize as to what a given species of bird may or may not be able to do. J. A. ALLEN.

STUDIES IN LOGIC.

Studies in logic. By members of the Johns Hopkins university. Boston, *Little, Brown, & Co.*, 1883. 7 + 203 p., 2 pl. 16°.

MR. C. S. PEIRCE and four of his students, present or recent members of his logic classes at Baltimore, offer us in this work six distinct essays on topics of recent logical theory, besides three shorter contributions classed as notes. The volume is throughout studiously unpretentious and very solid work, that might have made much greater claims with perfect safety. The style is extremely compact, and the purchaser of the book will pay for no padding.

Four of the longer studies appeal only to very special students. The two others, Mr. Marquand's essay on the 'Logic of the Epicureans' and Mr. Peirce's very important study of the logic of induction, entitled 'A theory of probable inference,' will interest the general student either of philosophy or of scientific method.

Mr. Marquand's essay on the Epicurean logic opens the book, and gives us an account of the Epicurean theory of induction as it is stated in the work of Philodemus, that has been preserved in fragments in a Herculaneum papyrus. One could wish that this essay had been fuller upon some points; but as a whole we must accept it with thankfulness, as containing useful and not otherwise so easily accessible information. Mr. Marquand then discusses a 'Machine for producing syllogistic variations,' and adds a 'Note on an eight-term logical machine.'

Then follow two 'Algebras of logic,' by Miss Christine Ladd (now Mrs. Fabian Franklin) and Mr. O. H. Mitchell respectively. These are new structures on Boole's foundation. Miss Ladd uses two copulas, expressed by the symbols $\bar{\vee}$ and $\vee$. With these she is able to write algebraically all the old forms of statement, and to perform the customary operations of symbolic logic with great brevity and facility. The copula $\bar{\vee}$, a wedge, is used to signify exclusion. A $\bar{\vee}$ B means that A is wholly excluded from B; i.e., that no A is B. This copula is not to imply the existence of the terms of the statement. The copula $\vee$, an incomplete wedge, is the symbol of imperfect exclusion. A $\vee$ B means that some A is B. And this copula is taken to imply the existence of the terms of the statement. The symbol ∞ is used for the universe of discourse. The symbol 0 finds no use in this algebra. $x \bar{\vee} \infty$ expresses the non-existence of the class x; and this is written more briefly $x \bar{\vee}$. The notation thus established has the convenience that $a \bar{\vee} b = ab \bar{\vee}$, $abc \bar{\vee} = a \bar{\vee} bc$, etc., and, with a corresponding notation for the other copula, $abc \vee = a \vee bc$, etc.; so that the factors of an excluded or not excluded combination may be written in any order, and the copula may be inserted at any point or written at either end. The notation is further applied to combinations of propositions, and to the processes of elimination; and the relative simplicity of expression is preserved throughout.

Mr. Mitchell expresses propositions as logical polynomials, consisting of sums of terms, formed after Boole's fashion. The classes indicated by the polynomials are stated in the propositions to form either the whole or some part of the universe of discourse. Thus, the proposition that the universe $U = \bar{a} + \bar{b}$ would mean that no a is b. Such a proposition Mr. Mitchell expresses by the notation $(\bar{a} + \bar{b})_1$; or, in general, if F be any logical polynomial, F_1 means that F precisely fills up the universe. F_u would express that F forms some part of the universe. $\bar{F}_u$ means that $\bar{F}$ forms part of the universe. Propositions thus formed are used for the purposes of inference in a simple way, expressed in Mr. Mitchell's words by the rule, "Take the logical product of the premises, and erase the terms to be eliminated."

The foregoing may serve to suggest to any one acquainted with Boole's notation the drift of the innovations proposed in these two algebras. Psychological importance, as Mr. Peirce himself suggests, these two notations can hardly claim. They tell us nothing new about the nature of the thinking process, but are interesting only as ingenious and possibly useful methods for expressing very briefly complex facts and elaborate logical calculations. As such expressions, they will hold their own, and may even be noticed in that not very distant time when the whole earth shall be filled with logical algebras, whereof there shall be, for all we can now see, as many as there are tiles on the roofs of the houses.

Mr. B. I. Gilman's very special study follows, on 'Operations in relative number, with application to the theory of probabilities.' Then comes the strong piece of the book, Mr. Peirce's before-mentioned discussion of the logic of induction. This we have read, not with entire conviction, but certainly with no little admiration. Readers of Mr. Peirce's fine papers called 'Illustrations of the logic of science,' in the *Popular science monthly* of

some years back, will be glad to find here, in a more elaborate and technical form, the theory of induction that was outlined in one of those papers. It is, philosophically considered, the most ingenious account of the subject that we have anywhere read; but, as said, we still hesitate to accept this account as complete. But space forbids any lengthy statement of our difficulties in this connection. We must be content with few words.

Mr. Peirce brings the theory of induction into direct connection with the general theory of probable inference, but does so in a way of his own. He rejects, in the first place, any notion that the occurrence or non-occurrence of an event in the past in any way affects the probability of its occurrence in the future. The doctrine of inverse probabilities, as it has hitherto been applied, Mr. Peirce considers as furnishing no foundation for the theory of induction, and equally does he reject our old and trusted friend, the postulate of the uniformity of nature, as the basis of inductive inference. One may well ask, remembering Hume, what yet remains when these faithful allies have failed. But Mr. Peirce's insight finds yet another resource, — not the probability that a given event will be repeated in the future, but the probability that a given form of inference would, in any constitution of the universe whatever, tend in the long-run to lead us to truth rather than to error: this is, for Mr. Peirce, the ground of the true inductive inference. Thus, then, the universe need have no peculiar constitution to render inductive inference valid.

The inductive inference, then, is to be expressed as one form of probable inference. Simple Probable Deduction is exemplified in the typical syllogism:

The proportion ρ of the M's are P's;
S is an M;
It follows, with a probability ρ, that S is a P.

This means that the conclusion, S is P, would in the long-run, and if S is chosen at random, be true in a proportion, ρ, of cases. — More complex is Statistical Deduction, of the form:

The proportion r of the M's are P's;
S', S'', S''' are a *numerous* set, taken at random from among the M's:
Hence, probably and approximately, the proportion r of the S's are P's;

that is, the more M's we choose at random, the more likely it is that the same proportion of P's will appear among the chosen M's as exists among the whole actual number of M's. — But now suppose, that, knowing nothing of the real proportion of P's among the M's, we undertake to discover this proportion by sampling the M's. Then we have but to employ our previous principle, and say that the more M's we choose at random, the more will it be likely that the proportion of P's among the chosen M's will equal, and so will reveal, the actual proportion of the P's among all the M's. But now we have induction. We do not assume any thing about the constitution of the unknown parts of the class M. We make no postulate of the 'uniformity' of the class M. That I have found one M that is P, or more, makes it no more probable that the next M found will be P. But we conclude only that the conclusion reached in the following syllogism is reached by a method or precept that must in the long-run lead us towards truth, and away from error. The typical inductive syllogism is:

S', S'', S''', etc., form a numerous set, taken at random from among the M's;
S', S'', S''', etc., are found to be — the proportion ρ of them — P's:
Hence, probably and approximately, the same proportion, ρ, of the M's are P's.

Thus sampling, continued and fair, tends toward truth, and gives us justifiable ampliative inferences, whatever the constitution of the things about which we infer. Mr. Peirce applies a similar analysis to the form of induction which he calls hypothesis.

This is a very inadequate sketch of a view that deserves serious attention. Of all attempts at a purely empirical theory of our knowledge of nature, this is one of the most promising. We should be sorry to prejudge it in any way by adding to our lame exposition hasty criticism; but, when we say that the theory seems to us to fail just at the most important point, we express what, fairly or unfairly, many readers will feel. The most important point lies in the words 'chosen at random.' Mr. Peirce himself, with perfect fairness, suggests some of the difficulties involved in this word. 'Sampling,' he says 'is a real art, well deserving an extended study by itself.' But does not this art depend for its very existence on an *a priori* assumption about the structure of the universe? Is not a world of which we know that in it we can choose our S's at random from among the M's a world of which we already must know a good deal? Mr. Peirce makes one admission about such a world. It is, he tells us, a world in which we must assume that there are no supernatural and malignant powers at work confusing our choice; i.e., making our supposed random

choice really unfairly predetermined and so deceptive. If, he thinks, the supernatural powers let us alone to choose for ourselves, then our inductions, properly guarded, will inevitably lead us in the direction of true conclusions, whatever the arrangement of the real world. But has Mr. Peirce made all the necessary admissions? Would a devil be needed to confuse my efforts at sampling, so as to make my choice unfair? Would not an instinctive interest in one class of cases serve to vitiate the fairness of my observations in cases where this instinct controlled me? Suppose that by instinct I took such interest in the cases of M's that are P that I noticed no cases, or very few cases, of M's that are not P, however many there might actually be: then, unless I were conscious of this instinctive preference, I should go on neglecting numberless cases that I ought to have taken into account in forming my induction; and yet, not knowing my own natural defect, I should think that I was choosing my cases wholly at random. Here would be a constant error in the process, whose magnitude might be enormous. Yet the error could never be discovered, save by some one to whom a new mental growth made possible the discovery of the instinct. But this case is no factitious one. Our observation of nature is doubtless determined throughout by our natural interests in things. These interests are instinctive, and they may exclude from the very possibility of notice very many facts. Thus, a person that by nature is indisposed to notice the double images in the binocular visual field will study his field of vision for a long time, and will assure you that there is no doubleness there. Might he not say, that after making at random many trials, and finding no double images, he was warranted in the conclusion that for him the proportion of double images in the visual field must be extremely small? Yet once begin to notice the doubleness, and the double images will be found in multitudes, like the chariots and horses that Elisha's servant saw when his eyes were 'opened.'

When we conclude that continuous random sampling of a given natural class must lead us towards discovering the true proportion of cases of the presence of a predesignated character in individuals of the class, must we not base our conclusion on the ultimate *a priori* assumption that our instinctive tendencies to observe natural facts are such as, in the long-run, will lead us to actual choice at random, and not to a choice unconsciously vitiated by unknown preferences for cases that favor the conclusion that we reach? And is not induction, therefore, still dependent on an *a priori* assumption about the nature of reality?

But these inadequate negative suggestions must not give the impression that the foregoing is the whole substance of this very compact essay, which is full of valuable thoughts upon scientific method, and which must be read in detail to be appreciated. We hope for much more such work as this book contains, for the result cannot fail to be of value alike to American science and to American philosophy. Those who oppose a purely empirical philosophy must still be aided by finding so able a defence of some of its doctrines, and those who believe in other forms of logical doctrine cannot afford to remain ignorant of the advances of symbolic logic.

THE RACES OF MEN.

Les races humaines. Par ABEL HOVELACQUE, professeur à l'École d'anthropologie. Paris, *Cerf*, 1882. 159 p., illustr. 16°.

THIS rather attractive work is written on a practical plan, which is specially useful in tending to correct the false impressions generally entertained, connected with the term 'race.' It is strictly limited to ethnography as distinguished from ethnogeny and ethnology, and simply considers the actual divisions of mankind, with their geographical areas, and their physical, intellectual, and moral characteristics. In the classification of races, the old division by color — as white, yellow, black, etc. — is repudiated; the fact being established, that other characteristics, such as those relating to the hair, to the shape of the cranium, and to height, are equally important, and that none of them can be exclusively adopted in class arrangement. Failure likewise attends a merely linguistic and a strictly geographical grouping. The attempt to discuss races in the order of their development toward civilization would seem to be philosophic, but meets with the difficulty that bodies of men, who, by all other considerations are to be included in the same race, are at wholly diverse degrees of progress in civilization. Admitting, therefore, that no single criterion is possible, the author decided to take account, with due weight, of all the different elements of classification, and to leave to the presentation itself, by its success, the responsibility of justifying its own order.

Professor Hovelacque's arrangement, as distinguished from strict classification, is as follows: 1. Australians; 2. Papuans; 3. Mela-

nesians; 4. Bushmen; 5. Hottentots; 6. Negros of Soudan and Guinea; 7. Akkas; 8. Kafirs; 9. Nubas; 10. Pouls (Foulas or Fellatas); 11. Negritos; 12. Veddahs; 13. Dravidians; 14. Mundas (Kohls and Kolarians); 15. Indo-Chinese; 16. Siamese; 17. Birmese; 18. Himalayans, including Thibetans; 19. Annamites; 20. Cambodgans; 21. Chinese; 22. Japanese; 23. Ainos; 24. Hyperboreans; 25. Mongols; 26. Malays; 27. Polynesians; 28. Americans; 29. Caucasians, including Circassians, Georgians, etc.; 30. Berbers; 31. Semites; 32. Asiatic Aryans; 33. Occidentals or Indo-Europeans.

The author expressly states that his intention has been to devote much more space to the inferior than to the superior divisions of men, and to treat with detail only of those less known. As he allots only five pages out of the one hundred and fifty-six of the volume to the North-American Indians, he must consider them to be 'superior,' and well understood. But they are not apparently thoroughly understood by him. His enumeration, not only of tribes, but of the most important linguistic stocks, is imperfect and inaccurate. He is wildly at fault in many of his generalizations, some of which it seems proper to correct. The Indian is said to dwell in miserable huts made of poles united in a cone and covered with skin. It is true that the conical form of temporary lodges prevailed from obvious circumstances; but the material for covering was much more frequently of bark and mats than of skins; and the more permanent dwellings were of various styles and materials, in which neither poles nor skins appeared, and were often comfortable. The statement is distinctly made, that each family lived in its own particular hut or cabin. The rule is almost without exception, that, apart from the temporary lodges, all dwellings were adapted to the living-together of several families: in other words, they were communal. Furthermore, the error is repeated, that the Indians subsisted almost entirely on the products of the chase, supplemented only by such vegetables as were the spontaneous productions of nature, all cultivation of the earth being despised. The fact is, that every tribe east of the Mississippi and between the St. Lawrence and the Gulf of Mexico cultivated the soil sufficiently to derive an important part of its subsistence therefrom. In general it may be remarked of the author's statements regarding the North-American Indians, that, when true at all, they are true only of particular tribes, and are not of wide application. In this he has merely travelled in the path of other European writers who have regarded these people as of a single homogeneous race; whereas by the criteria of language, physical characteristics, environment, etc., used for other parts of the world, there would be as much propriety in his dividing the North-American stocks as in several of the other divisions above quoted. When, moreover, he lumps the Indians of North and South America together, he does little better and is less candid than the old geographers, who labelled a fancied line 'terra incognita.'

GAGE'S ELEMENTS OF PHYSICS.

A text-book of the elements of physics, for high schools and academies. By Alfred P. Gage, A.M. Boston, *Ginn, Heath, & Co.*, 1883. 10+414 p. 12°.

Because we find lightning explained as the thunder-bolts of Jove, forged by Vulcan, remembering that this was no poetical idea, but the actual belief of a simple folk; because the Indians explain the setting of the sun by saying that it has burrowed into the earth; because such gross explanations satisfy the mind not yet developed, — should we in our teaching, that our knowledge may appear the more complete, make use of such false fancies?

Many teachers find it of supposed advantage to make use of the atomic theory in explaining solution, expansion, or the fact of smell. This gives, it is true, a clear picture of a possible mechanism. But is there not a danger, when the slender grounds there are for proof of such suppositions are found out, that the student may turn away, feeling that the whole structure of physics is built upon such conceits?

There is the satisfaction of a clear picture, which can be understood and compared with more tangible phenomena. But is not this a loss, when obtained at the expense of bringing in a conception of matter for which there are reasons, but reasons of a nature which cannot be appreciated by the beginner?

This prominence of atoms is an old bugbear of elementary text-books. Yet our knowledge in regard to them only dates from ten or twenty years ago, or, as Thomson would have it, from the work of Caudey on the dispersion of light. To be sure, the word 'atom' may be found in many a metaphysical discussion; but how could such wranglers, switching at phantoms, be expected to hit so small a thing?

It would seem safer to leave the causes of the general properties of matter as entirely unknown. When the child asks what becomes

of the sugar when dissolved, say we do not know.

Beyond this fault, which is common, the book is of merit as giving many experiments with apparatus of easy make. There is at times a lack of exact knowledge displayed, as from one who has studied in the schoolroom and not in the physical laboratory. But with the young learner the work will, without doubt, prove fresh and instructive.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Virtual change of the astronomical unit of time. — Mr. E. J. Stone has recently communicated to the Royal society an important paper on a virtual change of the astronomical unit of time, which has taken place in consequence of the difference between Bessel's expression for the sun's mean longitude and the corresponding formulae of Hansen and Leverrier. The investigation was primarily undertaken for the purpose of finding an explanation of the rapidly increasing discordance between the moon's place and that indicated by Hansen's lunar-tables; and, after a careful examination of a number of other hypotheses, Mr. Stone thinks he has found the cause as indicated above.

For the sun's mean longitude, —

Bessel gives $\odot = 280°46'36''.12 + 1,296,027''.6182\,t + 0''.00012218\,t^2$,
Hansen " $\odot = 280°46'43''.20 + 1,296,027''.6741\,t + 0''.00011069\,t^2$,
Leverrier " $\odot = 280°46'43''.51 + 1,296,027''.6784\,t + 0''.00011073\,t^2$,

in which t is reckoned, *as supposed*, in Julian years from Jan. 1, 1850, Paris mean noon. Now, the old observations which Hansen used in forming his lunar-tables, and in determining its constants, were reduced according to Bessel's formula. When we compare tables, thus formed, with observations in which the date of observation is referred to the sun's place by means of Leverrier's or Hansen's tables of the sun, just such a discordance must arise as if the length of the unit of time had altered; i.e., as if Bessel's Julian year were different from Leverrier's, which is now used in our ephemerides, having been adopted about 1864. Up to 1863, Hansen's lunar-tables were satisfactory: since then, the error of the moon's longitude has increased from $+0''.121$ to $+10''.265$.

Mr. Stone thinks this will also clear up some perplexing discrepancies in results as to the moon's secular acceleration. He points out that Hansen's tables "cannot safely be used in the discussion of ancient eclipses until the effects of this confusion of units of time have been cleared." [This abstract is made, not from the paper itself, which is not yet printed, but from an account given of it by Mr. Stone to the Royal astronomical society.] — (*The observ.*, May.) C. A. Y. [1014

MATHEMATICS.

Sub-invariants. — In the two instalments of his memoir which have thus far appeared, Prof. Sylvester enters upon a new development in the modern algebra; namely, the theory of semi-invariants regarded as belonging to a quantic of unlimited order, in which aspect he designates them as sub-invariants. An important distinction between regarding a semi-invariant as appertaining to a particular limited quantic and regarding it as a sub-invariant, is, that it may, while irreducible in the former character, be reducible in the latter. The new problem thus arises of determining the absolutely irreducible sub-invariants of any given degree and weight. In section I. a number of general theorems are established concerning sub-invariants appertaining to a single quantic, and to systems of quantics, all of unlimited order; and a method is indicated by which the author has succeeded in disproving the proposition that ground-forms and syzygants cannot coexist. Section II. contains tables of 'germs' for the quintic and sextic, the germ of a sub-invariant being the multiplier of the highest power of its last letter. Section III. is devoted to a systematization of the method of deducing the complete system of ground-forms of a quantic by direct algebraical operation from the simplest system of forms in terms of which any other form, multiplied by a power of the quantic, can be rationally and integrally expressed. The method is due to Prof. Cayley, and is easily applied to the cubic and the quartic; but, beyond these very simple cases, its application would be practically impossible without the aid of the methods now introduced by Prof. Sylvester. The application to the quintic is given *in extenso*. Section IV. treats of absolutely irreducible sub-invariants; the generating functions are obtained for absolutely irreducible sub-invariants of the first seven degrees; from the generating function for the seventh degree it is inferred that ground-forms and syzygants must necessarily coexist in the case of quantics of a sufficiently high order, which constitutes the disproof above referred to. This section is followed by an excursus on rational fractions and partitions. (See **1016**.) — (*Amer. journ. math.*, v. 1, 2.) F. F. [1015

Rational fractions and partitions. — In an excursus on this subject, Prof. Sylvester gives, in an improved and more complete form, the theory of simple denumeration first published by him in 1855. The object of the theory is to find an analytical expression for the general coefficient in the expansion of the generating function; but its cardinal theorem applies to the expansion of any rational fraction, and not only of such as arise in the theory of partitions or denumeration. — (*Amer. journ. math.*, v. 2.) F. F. [1016

PHYSICS.

Heat.

Radiation and absorption of rock-salt. — Herr C. Baur has made some observations on this subject. His results do not agree with those of Melloni and Magnus. Melloni considered that heat, radiated from rock-salt, was not absorbed by plates of rock-salt, any more than heat radiated from other substances. Magnus found that rock-salt plates absorbed heat radiated from rock-salt much more than that radiated from other substances. He believed that the radiation from perfectly pure rock-salt would be completely absorbed by a plate of the same substance, and that the apparent exceptions to this law were due to impurities in the radiating plate. Herr Baur concludes from his experiments that, 1. Rock-salt absorbs its own radiations better than those from

any other body; 2. The absorption increases as the difference of temperature between the radiating and absorbing plates decreases; 3. The absorption is probably complete when both plates are at the same temperature. Magnus' exceptions were probably not due to impurities, but to a difference of temperature of the two plates. — (*Ann. phys. chem.*, xix. 1.) C. B. P. [1017

Electricity.

Hall effect. — Dr. E. H. Hall finds that the values of the 'rotational coefficients' given by him at the York meeting of the British association for zinc, aluminum, copper, brass, and lead, are confirmed by later experiments. On trying the effect of change of temperature, only a negative result was obtained with gold; with iron, the increase was two-thirds of one per cent, with a rise of 1° C. The coefficient, with change in the strength of the field from 1,000 to 7,500 absolute units, seemed to increase; but, of this, Dr. Hall does not feel sufficient confidence to publish his results. The object of another experiment was to determine whether any part of the rotational effect could be made permanent. For this purpose, a thin piece of very hard steel spring was used as the plate. The direction of the equipotential lines was permanently changed by the action of the magnet. This change was in the same direction as the temporary effect due to the magnet's action, and perhaps equal to two per cent of this. — (*Amer. journ. sc.*, xxv. 215.) [1018

ENGINEERING.

The power of a steamship. — The Oregon, of the Guion line, is to be the most powerful and the fastest of the transatlantic passenger-steamers. Her displacement is about 11,000 tons. Her engines have three cylinders, and are of 13,000-horse power. The boilers contain 74 furnaces, consume about 300 tons of coal per day, evaporate 2,700 tons of water, require 6,000 tons of air to support the combustion, or a volume of nearly 175,000,000 cubic feet, and the power developed is sufficient to raise about 200,000 tons one foot high per minute. The ship will make 20 nautical miles (knots) per hour, against an estimated resistance of 94 tons, or twenty times the resistance overcome by the most powerful locomotive. The Atlantic will be crossed in six days in good weather. — (*Lond. engineer*, April.) B. H. T. [1019

The exhaust-steam injector. — Mr. L. J. Groves read a paper before the Institution of engineers and shipbuilders in Scotland, March 20, describing the exhaust-steam injector. It resembles the feed-water injector of Henri Giffard both in principle and in its general construction. It forces the feed-water into the boiler by the action of the exhaust-steam at nearly atmospheric pressure, at the same time heating considerably the water passing through the instrument. It differs from the usual forms of Giffard injector in having the 'mixing' or 'combining' nozzle split in such a manner that it lies open when the apparatus is not working, but closes up to form the standard form of nozzle when the instrument starts into operation. The steam-nozzle is much larger than that of the common instrument, and has a central spindle, of cone shape, to direct and concentrate the jet. The instrument starts automatically when the engine starts. It draws cold water, and forces it into a high-pressure boiler at a temperature of 190° F. (88° C.). On a locomotive it has forced feed-water into the boiler at a temperature of 277° F. (136° C.), against a steam pressure of ten atmospheres. — (*Trans. inst. eng. shipb. Scotland*, April.) B. H. T. [1020

CHEMISTRY.

(Organic.)

Action of hydrochloric acid on caffeine. — When caffeine is heated with fuming hydrochloric acid to 260° in a closed tube, E. Schmidt finds that it is completely decomposed: —

$$C_8H_{10}N_4O_2 + 6H_2O =$$
$$2CO_2 + 2NH_2CH_3 + NH_3 + CH_2O_2 + C_3H_7NO_2.$$

Caffeine prepared from theobromine proved to be identical in its chemical and physical properties with the natural base. The decomposition of theobromine, when heated with hydrochloric acid, is shown by Schmidt and Pressler to be represented by the equation, —

$$C_7H_8N_4O_7 + 6H_2O =$$
$$2CO_2 + NH_2CH_3 + 2NH_3 + C_3H_7NO_2 + CH_2O_2.$$

By oxidation with nitric acid, theobromine gave methylparabanic acid and methylamine, and caffeine gave dimethylparabanic acid and methylamine. In the preparation of theobromine from cacao, Schmidt found in the mother-liquors needle-shaped crystals which proved to be caffeine. The action of hydrochloric acid upon xanthine is shown by the equation, —

$$C_5H_4N_4O_2 + 6H_2O = 2CO_2 + 3NH_3 + C_2H_5NO_2 + CH_2O_2.$$

— (*Ann. chem.*, ccxvii. 270.) C. F. M. [1021

Relative reactive power of the halogens in mixed haloid ethers. — L. Henry observed that in chlorbromethylen (CH_2ClCH_2Br) the bromine atom was removed by potassic hydrate, sodic ethylate, potassic phenolate, potassic acetate, and potassic sulphocyanate. Argentic nitrate substituted the group NO_3 for the bromine atom, and a bromnitrate of silver $\left(Ag_2{}^{Br}_{NO_3}\right)$ was precipitated in quantity corresponding to the amount of argentic nitrate taken. The author regards this fact as evidence of the formula $\begin{matrix} Ag - NO_3 \\ | \\ Ag - NO_3 \end{matrix}$ for the nitrate. When the latter reaction was tried on chloriodethylen, iodnitrate of silver was precipitated. By the action of nitric acid, the iodine atom was replaced by the group NO_2. In bromiodethylen, the iodine atom seemed to be much less reactive than in the presence of chlorine; and, in general, the difference in reactive power between chlorine and bromine was much greater than between bromine and iodine. — (*Comptes rendus*, xcvi. 1062, 1149.) C. F. M. [1022

METALLURGY.

A new refining process. — At a recent meeting of the Société de l'industrie minérale, M. Thiollier communicated the details of a method of refining pig, and finished iron and steel, by the action of damp hydrogen. To assure himself that the well-known laboratory experiment may be carried out on a large scale, he has erected experimental works near Paris, having four furnaces with cast-iron retorts capable of treating about one ton at a time. The retorts are coated inside and out with a vitrifiable substance to prevent oxidation, and loss of gas through the pores of the metal. Hydrogen is introduced through small metal tubes; and, in order to prevent all danger of explosion, the air in the retort is displaced by carbonic-acid gas before the hydrogen is allowed to enter. After being annealed for a few hours in an atmosphere of hydrogen at a dark-red to cherry-red heat, malleable cast iron acquires all the properties of steel. Coarse steels may be changed into fine tool steel. On wrought iron the action is slower. The cost is esti-

mated at two francs per 100 kilos of poor-quality iron. — (*Iron*, April 6; *Eng. min. journ.*, March 31.) R. H. R. [1023

The working of blast-furnaces. — At a meeting of the Society of mechanical engineers, Jan. 25, Mr. Charles Cochrane read an elaborate paper on the working of blast-furnaces with special reference to the conditions under which the analysis of the escaping gases is of value. The object of the author is to establish the fact that all economy in fuel, consumed to make a ton of pig iron with any particular class or size of furnace, is governed by three conditions: 1. Temperature of air introduced; 2. Temperature of escaping gases; 3. The quantity of carbon which can be maintained in the condition of carbonic-acid gas after it has once been transformed to this degree of oxidation from the carbonic oxide produced in the hearth. The paper contains tables calculated for conditions varying from good to bad. Several illustrations of furnace-working are given, of which the No. 3 Ormsby furnace is one. The ratio of carbonic acid to carbonic oxide was 424. The temperature of the blast was 700° C.; of the escaping gases, 340° C. Carbon as coke, per ton of pig, was 21.98 cwt.; carbon in limestone flux, per ton of pig, was 1.50 cwt. By the tables it is shown, that, without the weight of carbon as a factor, there are six conditions of furnace-working indicated by the analysis of the gases; but, taking the carbon also into account, it is shown that the ideal furnace should have used but 16 cwt. of carbon per ton of pig: hence 5.98 cwt. of carbon have been reduced from carbonic acid to carbonic oxide. — (*Iron*, Feb. 2.) R. H. R. [1024

The Carvés coking system. — The ovens are long, high, narrow chambers of brick-work built side by side. The partition-walls contain horizontal flues as well as the floor of the ovens. No air is allowed to enter; and the only opening left during the heating is the pipe which carries the volatile products through condensation and absorption apparatus in order to save the tar and ammonia-water. The gas is conducted by the floor-flues to the small fire-grate at one end of the oven, and there burned; the products of combustion pass through the wall-flues, on their way to the stack; and, by this means, much heat is saved. There is no burning and consequent loss of the coal itself, as is the case in the beehive ovens; also the valuable by-products are saved. Tests show that the hardness of the coke increases as the width of the oven decreases. The cause of this is probably due to the quick and intense heating. The fixed carbon obtained in this way is about 75 per cent, while other methods give only 55 to 65 per cent. A battery of one hundred ovens will furnish steam for about 400 horse-power over and above the making of the coke and the rendering of the products. — (*Coal*, March 28.) R. H. R. [1025

Artificial fuel. — The process of Mr. E. F. Loiseau for making artificial fuel from coal-dust is in successful operation in Philadelphia, where from 80 to 300 tons, according to size of the lumps, are made daily.

The process of manufacture may be briefly outlined as follows: —

The coal-dust is fed into hoppers, together with about eight per cent of bituminous slack, from which it passes through a series of four cylindrical revolving drums, in which it is thoroughly dried. From these it is carried to a receptacle situated near the press. The dust, still at a temperature of about 140° F., is then thrown into the mixing apparatus, in which it is thoroughly stirred by revolving shafts with blades, while the proper quantity of pitch and coal-tar is added from a reservoir in which it is maintained at a temperature of 180° by steam-heat. The pitch is mixed with a certain quantity of coal-tar to give it the proper toughness. When thoroughly mixed with the melted pitch, the mass is plastic, and can readily be moulded into any desired shape. It is then carried to the press, where it is delivered between rolls having moulds upon their surfaces, from which the egg-shaped lumps are discharged. When discharged from the press, the lumps are quite hot, and have to be cooled by jets of water.

As thus prepared, the fuel is compact and very hard. Formerly clay was used as a cementing material, but now no incombustible or ash-producing material is required. The fuel is said to be even superior to the natural coal; and this opinion is borne out by an analysis which gave the following results: —

	Chestnut anthracite.	Loiseau fuel.
Carbon	73.40	82.01
Hydrogen	3.09	2.56
Moisture	0.44	2.41
Ash	17.95	10.47
Nitrogen and oxygen by difference	5.12	2.55
Theoretical calorific power, British thermal units	12,339.50	13,853.09
Equivalent to the evaporation, from and at 212°, of lbs. water	12.76 lbs.	14.33 lbs.

[1026

AGRICULTURE.

Earth-worms and fertility. — According to Hensen, earth-worms increase the fertility of the soil by forming burrows through which the roots of plants can descend into the subsoil. This applies chiefly to Lumbricus terrestris, while L. communis is confined chiefly or entirely to the surface-soil. The tap-roots of many plants, he thinks, may be able to force their own way through the hard subsoil; but the more slender side-roots descend chiefly through worm-burrows, or other channels, such as those left by old decayed roots. By excavating in frozen ground, he was able to trace roots downward through worm-burrows, and to observe that the layer of excrements with which the latter were lined was covered with a delicate network of root-hairs proceeding from the root in the interior. An important function of these roots Hensen believes to be, to supply the plant with water from the moist subsoil; and this is particularly important in the case of quick-growing annuals, like the cereals, which must develop their root-system rapidly, and frequently have to withstand prolonged dry weather. It is plain that no new material can be added to the soil by earth-worms; but they effect the fixation of vegetable matters in the soil by drawing into their burrows leaves, and other loose fragments of vegetation: they hasten their decomposition, and distribute them through the various layers of the soil. — (*Landw. jahrb.*, xi. 661.) H. P. A. [1027

GEOLOGY.

Lithology.

The Ardennes phyllites. — Extended chemical and microscopic examinations of the Ardennes phyllites by Renard show that they are composed of sericite, chloritoid, and either quartz or calcedony, with variable quantities of magnetite, hematite, pyrite, pyrrhotite, ottrelite, sillimanite, rutile, tourmaline, zircon, garnet, and carbonaceous material. Apatite was observed in one specimen. — (*Bull. mus. roy. Belg.*, i.) M. E. W. [1028

Archeological lithology. — Jannettaz and Michel from chemical and microscopic examination of two fragments of images obtained in Oaxaca, conclude that the rock is serpentine. Like examination of a pierced cylindrical bâton from Tetihuacan caused it to be regarded as a microcrystalline albite. The rocks were respectively colored greenish gray, deep green, and milk-white with a greenish tinge. — (*Bull. soc. min. France*, April, 1883.) M. E. W. [1029

Meteorites.

Fusion structures in meteorites. — The reviewer having expressed himself favorably (**24**) regarding an abstract of Wiechmann's paper, it becomes necessary, on examination of the completed form just published, to withdraw his commendation. The paper is a rambling, nearly worthless essay. So far as we can judge, the conclusions appear to be in the main correct; but they are mere guesses so far as this paper goes. The plates are coarse and unnatural. The only real evidence the article contains (which can be found on almost every page) shows the author to be destitute of the elements of the knowledge necessary for the work he has undertaken. — (*Ann. N. Y. acad. sc.*, ii. 289.) M. E. W. [1030

MINERALOGY.

Pachnolite and thomsenolite — Since the analyses of J. Brandl have shown these very similar minerals to have the compositions ($Al\ F_3$, $Ca\ F_2$, $Na\ F$) and ($Al\ F_3$, $Ca\ F_2$, $Na\ F$, H_2O) respectively, Des Cloizeaux has subjected the same to renewed optical and crystallographic examination. The crystals of pachnolite are always very small, and associated intimately with the thomsenolite. When heated in the closed tube, they decrepitate violently, giving no water. They are referred to the monoclinic system, with axial relation $c : b : a = 1.326676 : 1 : 0.859495$ $\beta = 89° 41'$. The thomsenolite is distinguished by its perfect basal cleavage. When heated in the closed tube it decrepitates violently, giving off acid water. The crystals are monoclinic, with the faces of the hemi-octahedron and prism striated parallel to their intersection with the base, and having the axial relation $c : b : a = 1.0883 : 1 : 0.998741$ $\beta = 89° 12'$.

These two minerals, which have been much confounded and united, are thus shown to be distinct, not alone in chemical, but also in physical and crystallographic properties. — (*Bull. soc. min.*, v. 317.) S. L. P. [1031

PHYSICAL GEOGRAPHY.

Ripple-marks. — The cause of the production of ripple-marks in marine sands, lately investigated by A. R. Hunt (*Proc. roy. soc.*, xxxiv. 1882, 1), has been further studied by C. de Candolle. He shows that they are caused by a horizontal oscillating or intermittent motion of the bottom-water, generally arising from the effect of wind on the surface, and makes it probable that they are produced at very considerable depths, and in directions independent of the surface-winds blowing. Such ripples are always formed on the surface of a viscous mass when a liquid moves back and forth, or intermittently forward, over it. Attention is called to the possibility that rippled cirrus clouds may have a similar origin, and to the resemblance between some artificial ripples and certain organic forms. Several well executed plates illustrate the paper. — (*Arch. sc. phys. nat.*, ix. 1883, 241.) W. M. D. [1032

Patagonia. — C. Martin calls attention to the contrast, dependent on the winds and consequent rain, between the country east and west of the southern Andes. North of lat. 40° S., where even the passes approach the height of Mont Blanc, this contrast is strongly marked; but farther south the cordillera is broken, and gives more open passage to the moist winds. At its eastern foot the numerous and large lakes are all fresh, having overflow during at least part of the year. Farther eastward the country becomes dry and barren, though nowhere being a desert of drifting sand. Its small lakes are saline. The Patagonian Andes, therefore, do not constitute a continuous range, but consist of a series of moderately high volcanoes on the ragged western border of the tableland, deeply cut by fiords and by rivers, that in some cases rise at a considerable distance from the Pacific coast, as found by the explorers, Cox, Fonck, and Musters. Forests extend as far north as lat. 35° S., but there they are found only on the mountain spurs. South of lat. 37° the lowlands also are forest covered, except where occasionally cleared by the Indians, who have, till lately, occupied this district to the exclusion of Spaniards and Chilians, and again between Valdivia and Osorno (lat. 40° to 42° S.), where opened by German colonists. The mainland and archipelago of the fiord region, where the Chilian hydrographer, Simpson, has counted over one thousand islands, are well wooded, the trees extending above the foot of the glaciers, up toward the snow-line. A brief description is given of the more important forest-trees. A peculiar building of lake-barriers is described (whether on sufficient observation or not does not appear) at several points in the southern fiords; for example, in the bay into which the glacier from the flank of San Valentino (3,870 met.) gives off its bergs, which, on melting, form a bar like a moraine, and in time enclose a part of the bay, which then becomes fresh by outward drainage. One such lake has already been formed here, and another is forming. — (*Mitth. erdk. Halle*, 1882, 88.) W. M. D. [1033

GEOGRAPHY.

(*Europe.*)

Surface and structure of Wurtemberg. — Beginning with a quotation from Murchison, — "No really good topography can be made by any surveyor who neglects geological data," — E. Hammer describes the close relation between the geological structure of Wurtemberg and the form of its eroded surface. Valleys cut in the *buntsandstein* have evenly rounded side-slopes; in the *muschelkalk* the slope begins abruptly at the line of a hard upper stratum, and sinks directly to the base; in the *keuper* the slope is broken by steps or terraces of harder and softer layers. Most of the larger streams follow the *muschelkalk*, and their upper courses meander so irregularly that the most ordinary topographic map reveals its presence. The forms of the successive lias, Jura, and tertiary deposits are given in detail. In upper Swabia, glacial deposits present their peculiar landscape of systemless hills and hollows, with drainage so imperfectly established that peat-swamps occupy a considerable part of the surface. The lack of illustrations decreases the value of this paper; but its method is excellent, and should find many followers. — (*Kettler's zeitschr. wiss. geogr.*, iii. 93, 148.) W. M. D. [1034

Area of Italy. — The official estimates of the area of Italy give a surface of 296,323 □ kil., according to figures established in 1864; but in the past year several statistical almanacs have changed this to 288,540 □ kil., according to the results of Gen. Strelbitsky (*Superficie de l'Europe*, 1882). Prof. G. Marinelli of the university of Padua does not ap-

prove of this change, as he regards the cartographic material on which the new estimate was made as of less than mediocre value. — (*Boll. soc. geogr. ital.*, vii. 1883, 241. Further discussion of the question is given in *Atti istit. venuto*, ix. 1883, 179, 295.) W. M. D. [1035

(*Asia.*)

Euphrates valley. — A corrected sketch-map of M. v. Thielmann's route from Kerbela, near the Euphrates, westward across the desert valley to Palmyra, is prepared by R. Kiepert. It shows the great barrenness of the adjacent flat country, slightly indented by dry stream-courses extending north-easterly to the river. Some of these are two hundred feet below the general surface, and sometimes contain pools and springs. — (*Zeitschr. f. erdk. Berlin*, xvii. 458.) W. M. D. [1036

Improvements in Persia. — Dr. J. E. Polak concludes his account of an expedition to the Karagan and Elvend regions in 1882 by noting the changes in the country since his earlier visit in 1860. In addition to the overland telegraph-line that connects India with Europe, there are several shorter lines across the country. The service is regular, and despatches can be sent in English and French as well as Persian. Many new roads have been constructed, and, although not to be compared with the smooth highways of Europe, they serve well for caravan traffic ; but roads are still lacking in many districts. A responsible postal-service is established, both for the interior and for foreign correspondence; and a uniform currency in gold and silver is introduced. With the improved means of communication, letters of credit can now take the place of a heavy supply of metallic money, that travellers formerly found necessary. Railroads are projected from the Caspian southward: they will have the advantage of finding coal and wood near their lines, but also the difficulties of heavy grades between the coast and the interior tableland, and a lack of good harbors at their termini. European methods are introduced in many civil and military arts, and a general tolerance of most sects and nationalities. Whether this improvement will continue or not is doubtful, as the present Shah is over fifty years old, and none of his sons give assurance of carrying on his reforms. — (*Mitth. geogr. ges. Wien*, xxvi. 1883, 106.) W. M. D. [1037

(*Pacific Ocean.*)

Polynesia. — An entertaining sketch of a three-years' voyage to many of the island-groups in the western Pacific is given by Dr. O. Finsch, who has lately returned to Europe with large collections. His studies were chiefly ethnological. Opportunity for such investigation is rapidly disappearing; for the local peculiarities of the natives on the various island-groups are fast fading away under the influence of traders and missionaries. Among the natives of the Marshall group, the making of large canoes from the trunks of breadfruit-trees is already a lost art. On one of the Caroline Islands, only about three hundred natives remain; and their earlier customs have largely disappeared with their conversion to christianity. In the Melanesian Islands there has been less change. The natives go naked, and retain their cannibal fashions; and, by the absence of certain peculiarities not at all flattering to our civilization, the lack of European influence is further proved. Herr Finsch found the atolls monotonous. "They are like American hotels: in knowing one, you know them all." The higher islands have much more interest. The irregularity of communication between the different islands makes travel very difficult. One must wait for accidental opportunities. With a little schooner of twenty tons, and a native crew of six or seven men, much more could be done. — (*Verh. erdk. Berl.*, 1882, 553.) W. M. D. [1038

Philippine Islands. — Dr. S. Kneeland regards this group, with many others south-east of Asia, as the remains of a sunken continent, finding evidence for this view in their broken outline, in the distribution of races and their monuments, and in the numerous volcanoes on the fracture along the border of the lost land ; but this latter point is certainly open to question, as is his opinion concerning the finished condition of the earth, and the office of volcanoes as safety-valves to earthquakes. Volcanic and seismic phenomena are very marked on these islands. The symmetrical cone of Mayou gave forth a continuous stream of lava from its very summit for the last five months of 1881, and, in earlier years, has done great damage to the villages on its flanks. The ruins of the old town of Daraga, on the south-east, may still be seen partly covered by the lava of 1814. Majayjay or Banajao, now dormant, formerly contained a lake that was destroyed in the eruption of 1730. 'Large stones thrown from it are scattered far and wide beyond its lava-flows.' From the lake of Bonbon, seventy miles in circumference, rises the cinder-cone of Taal, twelve hundred feet high, with a ragged crater six miles around, within which is a sulphurous lake giving forth suffocating fumes. The effect of earthquakes is seen in the change from heavy stone to light wooden buildings of Spanish construction. The most violent recent shocks at Manila were in 1863 and 1880. A meteorological observatory in charge of the Jesuits publishes a daily weather bulletin ; January and February have the coolest weather, with dry north winds; April and May are hottest; and August and September have the heaviest rains. Having an extent from north to south over several degrees of latitude, and a strongly broken surface, the islands enjoy a remarkable variety of climate, and the pine and maize flourish as well as the palm and orange. The author's chief attention was given to ethnographic questions, and some of his results have already appeared in SCIENCE. — (*Bull. Amer. geogr. soc.*, 1883, no. 2.) W. M. D. [1039

BOTANY.

Flowers of Turneraceae. — From studies by Urban, it appears, that, of the eighty-three species, fourteen are certainly homogone, and five probably so, while forty-eight are dimorphic, and eight probably so. Six species are incompletely dimorphic; one has six varieties homogone and six heterogone, and one is unknown, with respect to the length of the essential organs. Mathurina penduliflora, Piriqueta capensis, Berneriana madagascariensis and odorata, which depart most from the other Turneraceae, and are remarkable for their geographical distribution, are homogone. Aside from these, the homogone species are represented in all genera, and in most of the smaller groups of naturally related species, and they are distributed as widely as the order.

When a single individual of a species, found homogone in many specimens from different localities, shows an inclination to heterogony, this manifests itself in the increased length of the style, while the stamens retain their usual length. The northernmost variety of Turnera ulmifolia is represented only by the long-styled form. Certain species are characterized as incompletely dimorphic. The long-styled form is as it should be, while in the short-styled flowers the branches of the stigma nearly or quite reach the anthers. In these self-fertilization can

occur if insect visits fail. These are found only in groups where specific distinctions are not well marked.

In completely heterogone species, the differentiation extends only to the relative length of stamens and pistil, or it may include the direction of the short styles, which diverge so much as to bring the stigmas in contact with the perianth, or even the length of the stigmatic rays and the form and pubescence of the style. The colors of the flowers do not stand in any relation with the monomorphism or dimorphism. Dimorphic species have more conspicuous flowers than their nearest homogone relatives, this depending either on the size of the individual flowers or on their grouping in compact clusters. The duration of the several species shows a remarkable connection with the presence or absence of heterogony. The large-flowered, dimorphic species are perennials, while most of the small-flowered, homogone species are annuals. — (*Berichte deutsch. bot. gesellsch.*, 1883, heft 2.) W. T. [1040

Floral evolution in monkshood. — Grant Allen gives a popular account of the flower of Aconitum, contrasting it with a buttercup, and showing how symmetry and regularity have been lost, and its blue color acquired, through the advantage derived from the visits of bees favored by these changes. The bilateral structure, and the suppression of the lower three petals, are connected with the lateral position of the flowers on the axis of inflorescence; while the reduction in the number of carpels, and the increase in the ovules, secure the production of as much seed from a single visit of a bee as the buttercup secures from numerous visits of the mixed group of insects to which it is open. The differences in the relative position of the essential organs during anthesis would also have proved very interesting in this connection. — (*Knowledge; Pop. sc. monthly*, May.) W. T. [1041

The relation of the tension of the bark to the formation of annual rings in wood. — It is stated in several text-books, that, owing to the slighter pressure exerted by the bark in the spring, wider wood-cells are produced than at a later period, when the pressure is considerably augmented. Experiments by De Vries certainly can be interpreted in this way. Krabbe has recently investigated the subject in a somewhat different manner, and has arrived at a different conclusion. It cannot be said that the subject has yet been settled. It offers a promising field for further work.

Krabbe's method is the following: strips of bark, not as yet covered with cork, are carefully cut from the stem, and the amount of force required to restore them to their original breadth determined exactly by means of weights. It is well known that such strips of bark shrink at once, and that a considerable force is needed to bring them back to their former size. The tangential tension of the bark increases with the growth of the stem up to the time when the corky layer is formed, unless some injury influences the phenomenon. But if we look at the radial pressure (reckoned as the quotient of the tangential tension divided by the radius), it is found that this diminishes with increase of the stem in thickness. Furthermore, the radial pressure in autumn is about that of spring, never differing from it more than one gram in the square millimetre; hence being, as Krabbe thinks, too slight to account for the difference between the spring and autumnal wood. He explains the increase of growth, when pressure is removed by taking off the bark, by the pathological activity following wounds. — (*Sitzungsb. akad. wiss. Berl.*, Dec. 14, 1882.) G. L. G. [1042

ZOÖLOGY.

(*General paleontology.*)

Jurassic of Galicia. — In volume v. of the memoirs of the academy of sciences of Cracovia, Dr. Alth, under the title of the 'Limestone of Nizniow, and its fossils,' describes the recently discovered and very important beds of that locality. From the character of the fossils he refers them to the upper white Jurassic, answering to the united strata of the Kimmeridge and Portland. This work is important as showing the existence of the Jurassic in eastern Galicia, where it was formerly unknown, and of great paleontological importance as describing 179 species of fossils, of which 124 are new. Of these, 5 are annelids, 93 gastropods, 57 acephalans, 5 brachiopods, 2 echinoderms, 6 corals, 6 rhizopods, and 4 plants. Curiously, only one cephalopod has been found, the Nautilus Geinitzi. — (*Bull. soc. geol. France*, Jan., 1883.) J. B. M. [1043

The sigillarian stumps of Nova Scotia. — One of the most interesting results of the later visits of Sir Charles Lyell to this country was his discovery, in company with Dr. Dawson of Montreal, of a number of animals entombed in stumps of sigillarians in the coal-measures of Nova Scotia. Dr. Dawson has recently renewed his explorations in the field by aid of a grant from the Royal society of London, and his conclusions have just been published. Up to 1876, only three additional trees, of those which became accessible by the wasting of the beds, furnished animal remains. But by cutting and blasting, twenty others have now been examined, ten of them proving productive. Dr. Dawson finds that "the circumstances of the growth and entombment of this forest entirely contradict those theories as to Sigillaria and Stigmaria which suppose that these plants grew in water, or on submerged areas. . . . The surface on which the trees grew . . . must have been underlain by several feet of peaty matter." The number of terrestrial batrachians found in the stumps has been doubled by these investigations, additional species of Hylonomus and Hylerpeton having been found, and Fritschia and Sparodus added to the genera, besides a new form called Amblyodon, represented imperfectly by a few teeth and bones, — making, in all, seven genera and twelve species. Of land-snails, besides Zonites priscus, and Pupa vetusta, found before, another species of Pupa, called P. Bigsbii, has occurred. Of articulates, S. H. Scudder reports two more (unnamed) species of Archiulus, bringing the number of myriapods to six, and fragments of scorpions — not before recognized — probably belonging to two species. A half a dozen plates illustrate the batrachian remains. A note is added on the footprints of batrachians observed in carboniferous rocks of Nova Scotia, which are referred to six species, equally divided between Sauropus and Hylopus. — (*Phil. trans. roy. soc. Lond.*, 1882, 621.) [1044

Mollusks.

Variations in Unionidae. — Rev. W. C. Hey contributes a suggestive paper on the variations observed by him in Anodonta and Unio in the waters of the Ouse and the Foss, and the canals communicating with them, within a very limited area. The point of it is, that, apparently, very slight changes in the environment produce important changes of appearance in the mollusks referred to; though why such causes should produce such effects is not by any means clear. — (*Quart. journ. conch.*, 1882.) W. H. D. [1045

Action of the heart during hibernation. — C. Ashton has studied the action of the heart in hibernating helices. The observation is difficult owing to the opacity of the parts and the necessity of guarding against the temperature radiating from the observer's body. The pulse seems to be irregular, or rather, perhaps, to pass through active and quiescent cycles. Absolute inactivity of the heart probably does not occur during hibernation. Under scrutiny, the pulsations varied from three to twenty-two per minute. The animal is extremely susceptible to changes of temperature, as a touch of the finger will often double the rate of pulsation, which also rises with exercise or motion. — (*Quart. journ. conch.*, 1882.) W. H. D. [1046

Malacological notes. — Dr. W. Kobelt proposes to issue through Theodor Fischer, in Kassel, an iconography of European shell-bearing marine mollusks, which is much needed, and will be extremely useful to malacologists. It is to contain anatomical as well as conchological details, and will be issued in parts containing four plates each, in a colored and an uncolored edition, at the rate of a volume annually. —— Dredgings by Admiral Spratt in the Black Sea have been examined by Dr. Jeffreys, who finds them to contain six species of shells, hitherto unrecorded, from that basin, one of which (Trophon breviatus) appears to be peculiar. He regards the Black Sea zoölogically to be a mere offshoot of the Mediterranean, as the latter is of the North Atlantic. —— Bergh has printed in the *mittheilungen* of the zoölogical station at Naples a contribution toward a monograph of the nudibranchiate genus Marionia of Vayssière, — a group belonging to the Tritoniidae, and of which a few species are known in the Mediterranean and Red Seas. The paper is illustrated by a beautiful colored plate. — W. H. D. [1047

VERTEBRATES.

The heart as a suction-pump. — It has long been discussed whether the ventricle of the heart is not only a force-pump in systole, but also a suction-pump in diastole, actively dilating, and drawing blood into it from the veins. That within the closed thorax there is, due to the negative pressure prevailing in that cavity, an active diastole cannot be doubted; but is there such a diastole when the chest is opened, or does then the blood returned to the heart from the veins merely push apart the flaccid walls of the heart-chambers?

Goltz and Gaule have, among others, maintained the doctrine of such active diastole. Even with an open thorax, they found a negative pressure occurred in the heart during some part of a cardiac period · and, though their method of work did not enable them to determine at what moment in the heart's cycle this negative pressure occurred, they assumed that it was during the diastole. Moens, however, in a subsequent noteworthy paper, brought forward experimental and other proofs that the negative pressure in the left ventricle occurred at the end of the systole, and not in the diastole at all: if so, the heart was not a suction-pump. Jager now returns to the question; and taking as starting-points the assumptions, that, if negative ventricular pressure occurred at the close of the systole it must show itself in the aorta, but if during diastole in the auricles, he concludes that it is diastolic; since his experiments show that at no time is there a negative pressure in the aorta, while there may be such in either auricle. Accordingly, he maintains that the heart is a suction-pump. We may remark, however, that the correctness of his primary assumption is by no means certain: hence his whole argument falls to pieces. There is, on the contrary, strong reason to believe that the ventricular contraction lasts after closure of the semilunar valves, and that it is just at this very end of the systole that the negative intracardiac pressure occurs. — (*Pflüg. archiv*, xxx. 491.) H. N. M. [1048

'Mastzellen' of connective tissue. — The granular cells described in 1877 by Ehrlich, and since known by the name of 'mastzellen,' have been studied by Raudnitz. Their frequency in different organs and animals is very variable. They are generally abundant in the tongue, but are rare or wanting in the human tongue, and could not be found in any part of the rabbit. They are wanting in embryos, and are few in young animals. Raudnitz supposes that they are cells undergoing mucous degeneration. — (*Arch. mikr. anat.*, xxii. 228.) C. S. M. [1049

Haematoblasts of Hayem. — These little granular masses, which were first accurately described by Max Schultze (1865), have since been frequently observed; but their meaning and history have not been hitherto satisfactorily determined. Hayem believed them to be red blood-globules in process of development, and accordingly named them haematoblasts. Bizzozero has studied these bodies, which are about one-half the diameter of the red globules, in the circulation of living mammalia as well as in extravasated blood. In the latter they change with extreme rapidity, and each one becomes a centre from which the filaments of fibrine radiate, upon coagulation. When unaltered, these little disks are colorless, and bounded by nearly parallel surfaces. They have no nucleus, and contain two optically distinct substances, and exhibit with various reagents essentially the usual changes of protoplasmic bodies. Bizzozero denies that they change into red blood-corpuscles, as maintained by Hayem. The bulk of the memoir deals with the relation of these bodies to thrombosis and coagulation. The closing section is devoted to an account of these plates in cold-blooded animals. [Are not these bodies products of degeneration, perhaps amyloid?] — (*Virchow's arch.*, Nov., 1882. *Résumé* in *Arch. ital. biol.*, ii. iii.) C. S. M. [1050

The origin of apnoea. — In his third contribution, Knoll discusses the origin of apnoea. When rabbits in which the vagi are intact are made apnoeic by free artificial respiration, spontaneous respirations again appear only after the blood has become sufficiently venous to stimulate the vaso-constrictor, cardio-inhibitory, and other centres in the medulla. This depression of the irritability of the breathing-centre is so great, that, even when the blood-flow to the brain is cut off, no breathing-movements are called forth, although the vaso-constrictor centre becomes powerfully stimulated. This is in opposition to the results obtained by Rosenthal. The difference between his and Rosenthal's results may be owing, he thinks, to the latter having experimented upon animals with the chest opened. Although the respiratory centre in the apnoeic animal does not respond to stimuli from the blood, yet reflex stimulation, electrical or mechanical stimulation of the vagus or of the nasal mucous membrane, for instance, can still produce inspiratory contractions; not so readily, however, as in an animal not apnoeic. The production of apnoea in artificial respiration he attributes, in part at least, to a rhythmic stimulation of the vagi. In rabbits in which both vagi were cut, he succeeded in bringing about apnoea by artificial respiration only in five cases out of twenty; and in three of these there was evidence of diminished irritability of the respiratory centre from other causes. In the other cases a flattening of the respiratory curve could be perceived, —

a condition which he calls 'relative apnoea.' To obtain 'absolute apnoea,' one vagus at least must be intact. Moreover, when, by a special apparatus, the central end of the divided vagus was stimulated by a constant current at each artificial inflation, 'absolute apnoea' could in most cases be produced; although in the same animal, without corresponding stimulation of the vagus, only 'relative apnoea' was the result of artificial respiration. That this rhythmic stimulation of the vagus is only one of the factors in the production of apnoea is shown by the fact that artificial stimulation alone does not cause apnoea; while, with the vagi cut, artificial respiration alone will bring about a partial or relative apnoea, indicating a diminished irritability of the respiratory centre. — (*Wiener sitzungsb.*, lxxxvi. iii. 101.) W. H. H. [1051

Mammals.

Early development of rodents. — In a very important and interesting contribution to this subject, Kupffer describes the following discoveries from observations of the ova of the field-mouse, made upon sections through the uterus and egg *in situ*. The ovum of Arvicola forms a normal vesicle. In the germinal area lie the ectoderm and entoderm in the usual manner. The ectoderm consists, as in rabbits, of a 'deckschicht' (Rauber, *Sitzungsb. naturf. ges. Leipzig*, 1875) of thin cells, and a main layer of cubical cells, which alone enter into the formation of the embryo. The 'deckschicht' is temporary in the rabbit; but in the field-mouse it is the seat of a rapid and early proliferation, which leads to the formation of a knob of cells, which, on the one hand, is attached to the uterine-wall, and, on the other, forces in the germinal area, both ectoderm and entoderm. From the germinal area thus invaginated, into the interior of the ovum, the embryo is developed according to the typical method in mammalia. The mass of mesoderm-cells marking the primitive streak, and the position of the future allantois, appear at one end. The amnion folds are developed in front and behind from the inner ectodermal layer, and therefore inside the 'deckzellen.' The invagination of the germinal area goes so far that the whole egg is elongated in that direction, until it acquires a cylindrical form It is thus evident, that although the ectoderm occupies, as a result of the invagination, a central position, yet morphologically it always remains strictly the outside layer. — (*Sitzungsb. akad. wiss. München*, 1882, 621.) C. S. M. [1052

ec, ectoderm; *ec'*, ectoderm of germinal area; *en*, entoderm; *dz*, 'deckzellen.'

Embryology of rodents. — Paladino gives the following *résumé* of his results; and, as they have a slight priority of publication over recent German papers (ante **949-851**), they deserve especial attention. The whole cylinder formed during the first developmental stages of certain rodents is the embryo, and it is implanted on the decidual new formation by the caudal extremity. This is proved especially by the fact that it is this part from which the allantois arises. The cylinder, and the vascular portion of the decidual new formation, are continuous, and so remain throughout gestation by means of the vessels falsely called omphaloid. The decidua forms not only the placenta, but also the first envelope around the embryo, — the chorion, falsely so called. (This is in direct contradiction to the latest opinions of Hensen.) Between the embryo and the decidua is a large space, filled at first with blood, which Paladino thinks is probably produced by the metamorphosis of the granulosa cells discharged from the Graafian follicle along with the ovum (!). — (*Arch. ital. biol.*, ii. 363.) C. S. M. [1053

Germinal layers not homologous. — Repiachoff, whose singular hypothesis concerning the mammalian ovum was reported (**627**), has advanced the still more remarkable opinion that the germinal layers in vertebrates are not homologous primitive organs, and maintains that the same organ may arise in different animals from different layers. (This is directly opposed, especially as regards the notochord and the mesoderm, to which Repiachoff refers as illustrations, by the best recent investigations, and, indeed, the whole theory seems to the reporter without foundation.) — (*Zool. anz.*, vi. 148.) C. S. M. [1054

ANTHROPOLOGY.

Tylor's lecture at Oxford. — On Feb. 15 and 21, Prof. E. B. Tylor lectured at the University museum, Oxford, upon anthropology. The occasion was the instalment of a museum of civilization, the nucleus of which is the Pitt-Rivers collection, previously mentioned in SCIENCE. The speaker first drew attention to the fact that the theory of development has had its own evolution parallel with the progress of knowledge. Pritchard recognized the descent of mankind from one pair, whom he considered to have been negroes; and as we have been able to reconstruct the ancestry of the horse, Huxley leads us to hope that we may some day discover the fossil pedigree of his rider.

Mr. Tylor next spoke of the approach which cranioscopy is making to an exact science, drawing his illustrations from the crania of the British barrows, and other localities of undisturbed population. Comparative philology, properly understood, may tell its story in perfect accordance with anatomy. The blended parentage of the Fijians is heard in their speech, as it is seen in their faces. The cross-section of a single hair, examined microscopically by Pruner's method, shows it circular, or oval, or reniform; its follicle curvature may be estimated by the average diameter of the curls, as proposed by Moseley; its coloring-matter may be estimated by Sorby's method. This examination enables one to judge in what division of the human species to classify its owner. Climate, albinism, 'Addison's disease,' and other natural causes in their relation to race-color, are carefully considered.

It is upon the evolution of civilization, however, that Mr. Tylor is most happy, a subject to which he has devoted the most of his life. The last portion of the addresses, therefore, is devoted to the unfolding of several phases of social life in their relation to race and history. — (*Nature*, May 3.) [1055

The Trenton gravels. — Dr. C. C. Abbott has been observing closely the removal of gravel from the drifts of the Delaware near Trenton by railroad excavations, and has discovered new evidences of the existence of paleolithic man. The removal of the material reveals the fact that the beds were deposited at different times, masses of bowlders being overlaid by masses of sand, one of which, averaging a foot in depth, and extending nearly three hundred yards along the exposure, yielded not only the typical paleolithic implement, but four chipped stones of less definite shape, all of argillite. These objects were overcapped by a deposit nearly seven feet in

thickness, undisturbed, and containing several bowlders of large size.

Further research in the deposit, especially after a very severe storm, brought to light other rude implements which seem to be very old, and a human wisdom tooth. Dr. Abbott reviews also the discussion respecting the age and geological relation of the beds. — (*Proc. Bost. soc. nat. hist.*, xxii.) J. W. P. [1056

Nago language and proverbs. — Under the title of '*Les noirs peints par eux-mêmes*' (Paris, 1883), the Abbé Bouche, late missionary on the Slave Coast, presents an interesting pamphlet containing a large number of proverbs in the Nago language, with both literal and liberal translations and explanatory remarks. The proverbs show much of the customs and modes of thought of the people, and give a favorable view of their intelligence. They are, however, in large part extracted from the 'Vocabulary of the Yoruba language,' by Samuel Crowther, a native Nago, afterwards bishop of the Anglican church, though the Abbé Bouche claims to have made important emendations in the linguistic part of the work.

This pamphlet is the first publication of *L'oeuvre de Saint Jérome*, which was lately instituted to furnish mission-schools with 'classical works in the language of the natives,' or, in other words, to facilitate the study of the several languages in current texts of those languages, not to rely upon forcing a translation of religious works into the foreign tongue, which in many cases does not contain the words necessary to express the ideas connected with the Christian religion. This new departure in the right direction, by missionaries, is the mode employed by the Bureau of ethnology of the Smithsonian institution, and its general adoption will prove of the highest philologic value. — J. W. P. [1057

Chuckchis and Chuckchi-land. — An unsigned article on the Chuckchi describes their distribution, migrations, mode of life; the habits of the bands who live by herding reindeer, by trade between the American Innuit and the Russians on the Anui and Anadyr rivers, or by coast-fisheries; the care and diseases of the deer; the fishing population of eastern Siberia, and the fish they catch; and the initiation, purposes, and results of the Maidel-Neumann expedition to Chuckchi-land. The harmonious relations between the Russians and reindeer-Chuckchis now existing, and the manner in which they were brought about, are clearly stated. There is little new ethnological matter in the article, but a good deal of useful and interesting historical material, while the rest has been brought up to date. — (*Deutsche geogr. bl.*, vi. ii.) W. H. D. [1058

EGYPTOLOGY.

Book of the dead. — The editing of a critical edition of the Book of the dead was, by resolution of the International congress of orientalists held at London, committed to the hands of M. Edouard Naville. The work is now done, and is to be published under the direction of the academy of Berlin. It has been edited from the papyri of the seventeenth to twentieth dynasties. There is but little before that period to contribute to this edition; and, after that period, the acquaintance with the hieroglyphs of the Book of the dead was lost, and the chapters were written in the hieratic characters. The scribes copied mechanically, without understanding the signs they traced; and so the papyri in hieroglyphs, after the twentieth dynasty, are filled with errors. The most important papyri, which have been made the base of the present work, are those of London (9,900 and 9,964), of Paris (III. 1, III. 85, III. 93), and that of Mesemneter. These are all texts of the eighteenth dynasty. Almost all the chapters of the Book of the dead, as published by Lepsius, have been found elsewhere, and forty-three chapters, hitherto unedited, have been added. The first volume will contain the text and all the variants of the vignettes, which often differ from those published by Lepsius. The second volume will contain the variants of the text. While the title, 'Book of the dead,' has been retained, Naville calls attention to the special name of the book in Egyptian, '*per em hrou*,' and says, "I believe that it means 'departure from the day' ('*sortie du jour*'); that is, departure from his day. The Book of the dead contains expressions like the following: 'I have been delivered from the evil of those who are in their days,' or again, 'I have not blasphemed the King during his day,' where the variants are, 'during the continuance of his life.' To leave his day is not really to lose life or existence (life continues beyond the tomb), it is merely to be delivered from the period set for every terrestrial life, and to have neither beginning nor end, — an existence without limits in time or space: hence the frequent addition to the expression, 'departure from the day,' of 'under all the forms which the deceased wishes'; that is, to become released from the limits of time and space. . . . Whatever advantage there might have been in taking the Egyptian title, though imperfectly translated, yet I believe that now it is better not to break with usage, and to call the book 'Book of the dead' until Egyptologists agree upon a translation of the expression of '*per em hrou*;' for which I propose 'departure from the day or from his day.'" — (*Revue egyptol.*, iv.) H. O. [1059

EARLY INSTITUTIONS.

Land-system of the Franks. — H. Hahn sums up the conclusions of Dr. Schröder in his book entitled '*Die Franken und ihr recht.*' He tells us how the writer takes a position opposed to that of von Inama-Sternegg, whose *Wirthschaftsgeschichte* we read with so much satisfaction a few years ago (1879). According to this new view, the freemen were distributed in strictly communistic village communities (dörfer mit strenger flurgemeinschaft), under the over-lordship (obereigenthum) of the kings. This, we are told, was the condition of things as late as the sixth century. After that time, the system of isolated farmsteads with private estates (einzelhof-system) was introduced very generally. According to von Inama-Sternegg, as the reader will remember, the einzelhof-system was the primitive system. We are quite at a loss to imagine upon what grounds this new theory can rest. It seemed to us that that of von Inama-Sternegg was well established by the testimony of the early records. We wonder, for example, how Dr. Schröder reconciles his theory with the statement of Tacitus in Germania 16: 'Colunt discreti ac diversi,' and with that other statement (Germ. 25), that the freemen had slaves set out upon the land like Roman coloni. We wonder, too, how he explains the references to private property in arable meadow, and even forest-land, in Lex salica, xxvii. And what did the freemen do with their slaves, if they lived in communistically organized villages? Slaves are mentioned in at least nine sections of the Lex salica. Then, we remember all the early formulae and documents in which landed property is described. How can Dr. Schröder do away with all this testimony? We must not, however, attempt to discuss, still less must we criticise, an argument of which we have seen only a very brief report. — (*Mitt. hist. litt.*, 1882, heft 3.) D. W. R. [1060

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

STATE INSTITUTIONS.

Ohio meteorological bureau, Columbus.

Weather report for April. — The mean barometric height for the month of April, which was 30.009 inches for the state, was lower than any mean yet reported from this bureau. The maximum of 30.382 inches is also lower than that of any previous report. A lower minimum was reported for both January and March; so that the range is not so great as in previous months, being, in fact, less than any before given. The reports show no unusual atmospheric disturbance during the month.

In temperature the month was remarkable for the high point reached in many localities. The mean for the month, 48°.1, is above that of any other month included in the reports. A maximum as high as 90° was reached at Oberlin on the 14th; and the minimum for the state, which was 15°, was recorded at the same station on the 3d. Thus the thermometric range for the state, 75°, is reported from one station. This range is less, however, than any before published. The mean daily range, which was 21°.5, was somewhat greater than that for previous months. The station at the State university, which in January reported the minimum daily range, returns the maximum for this month, it being 42°.8. The minimum daily range is reported from Wooster, at which station the most uniform temperature for twenty-four hours has been recorded for three months in succession. Notwithstanding the unusually high temperature on certain days of the month, on the whole it was slightly colder than the normal mean for April, which is about 50°.

In the amount of precipitation, the month fell somewhat below the average for April, which is about 3.5 inches. The average number of days on which rain or snow fell was almost exactly the same as in March, but the mean depth of fall was considerably greater. It will be remembered that the rainfall during February was largely in excess of the normal amount; and it will be noticed, that, since that month, less than the usual amount has fallen.

The prevailing direction of the wind during the month was from the south-west; and thunder-storms are reported as occurring on the 4th, 5th, 9th, 11th, 13th, 19th, 27th, and 28th.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoology, Cambridge, Mass.

Recent additions. — The latest additions to the exhibition-rooms have been important, among them a fine skeleton of a fin-back whale, measuring over fifty-three feet in length. This skeleton, mounted by Ward, is suspended from the ceiling of the room devoted to mammals. The four skeletons of Moas, purchased for the museum at the Melbourne exhibition, have also arrived. They represent three genera and four species, and are probably, with the exception of those of the museum at Christchurch in New Zealand, the finest specimens discovered by Dr. Haast. The skeleton of Dinornis maximus measures over nine feet in height. It has been placed temporarily in the African room till a proper case can be built for it in the bird-room.

The series of anthropoid apes purchased from Ward — the orang, chimpanzee, and gorilla — have also been placed on exhibition. The African, Indo-Asiatic, as well as the Australian faunal rooms are now open to the public, although there are yet many blank spaces to be occupied.

The zoölogical collection is now so far arranged that the public can fairly estimate the advantages of the present distribution of limited exhibitions in comparatively small rooms devoted to special objects, as compared with the usual museum arrangement by which all the collections of an establishment are thrown open to visitors, without any attempt to select the more important or interesting objects, or to arrange them in an instructive manner.

As soon as the new geological and biological laboratories of the corner-piece are occupied, probably at the commencement of the next academic year, the same arrangement will be extended to the geological and paleontological collections.

The stalked crinoids of the Blake expedition. — The preliminary report of Mr. P. H. Carpenter on the stalked crinoids of the Blake (*Bull. mus. comp. zoöl.*, x. iv.) shows how greatly our knowledge of these animals has been increased by the recent dredging-expeditions. Not many years ago the specimens of Pentacrinus preserved in all the museums of the world could not have exceeded six or seven. Recently a few more specimens of a second species were collected at the Barbadoes; and the late Sir Wyville Thomson and Dr. William B. Carpenter had begun, with the help of this material, an extensive memoir intended to supplement the paper on Pentacrinus by Johannes Müller. But since the discovery of Rhizocrinus by the younger Sars, a number of genera and species of stalked crinoids have been dredged by the Norwegian, English, and American deep-sea explorers. With the exception of Rhizocrinus, however, none of the species were found in sufficient numbers to enable zoölogists to study them by the modern methods. Fortunately the Blake brought back from the Caribbean Sea two species of Pentacrinus in great numbers, a good supply of Rhizocrinus, and a couple of Holopus, all of which were placed by Mr. Agassiz in the hands of the late Sir Wyville Thomson for study. Since his death, all this material collected by the Blake has been transferred to Mr. Carpenter, who will incorporate his results in the final report he is preparing on the same subject for the Challenger expedition.

We may thus expect, judging from the excellent work done by Mr. Carpenter among the crinoids, an exhaustive memoir on this ancient group of crinoids, based upon ample material. Thus far, however, the study of the soft parts does not seem to have been so fruitful of interesting results as had been anticipated.

NOTES AND NEWS.

The signal-service under Gen. Hazen has issued a bulletin containing several reports, of which the first is that of Mr. W. M. Beebe on the relief expedition of 1882 to Lady Franklin Bay. This, as is well known, failed in its object, owing to adverse conditions of ice, etc. The second report, by Lieut. J. S. Powell, is on the relief expedition to Point Barrow for the purpose of replenishing provisions, and replacing any disabled members of the party. The attempt was also made to determine the astronomical position of the station at Uglaämie, near Point Barrow.

Lieut. Powell's narrative is lively and entertaining, containing numerous notes on the climate, people, and characteristics of the region he visited. The work of the station was going on in a manner believed to be satisfactory. Over 90,000 magnetic observations had been made from December, 1881, to August, 1882, by Messrs. Murdoch and Smith, and coincident meteorological observations carried on. Under the supervision of Lieut. Ray, in command of the party, daily exercise had been enforced, and other precautions taken for the health of the party, which had continued good, though it was thought best to replace two of them by new men. The determinations of position and chronometer rates are presented in a voluminous appendix by Mr. Winslow Upton of the signal-service; but owing to bad weather and other causes they were so unsatisfactory as to be worthless, and might better have been omitted. Precautions have been taken to secure better results this season. The third report is that of Lieut. Ray, and gives a general account of the work of establishing the station; of a journey made by him during the winter toward the north-east, where a river was discovered which was named Meade River; of the arrival of vessels in the spring, the loss of the whaler North Star, and other matters. Little is said of the scientific work of the station, for the reason, frankly stated by the author of the report, of his entire inexperience in such matters, his duties being solely of an executive nature. The extraordinary statement which follows appears in the last paragraph of the report, and is, we have reason to believe, based upon an entire misconception, the 'hut' spoken of having nothing to do with the magnetic observations. "Lieut. Powell brought but one magnetic hut, and it is designed for pendulum observations. I shall put it up, and use it for the new magnetic instruments; but I cannot be responsible for the results, as it is nailed with iron nails throughout." If the above were permitted to stand unexplained or uncorrected, every person possessed of any knowledge of magnetics, who might read this report, could not fail to experience the liveliest apprehensions as to the results of such proceedings on the quality of the observations. We believe, however, that it is due to the extreme haste in which the report was necessarily prepared, and that the statement, as it is, results from a transposition or accidental misuse of terms, such as Mr. Richard Grant White has taught us to call 'heterophemy.' The pamphlet is illustrated with a track chart of the Neptune in Baffin's Bay in 1882, and appears as 'Signal-service notes, no. v.' In the endeavor of the chief signal-officer thus to preserve in permanent form scientific observations apart from their stated work, which may be made by members of his corps, he will have the hearty sympathy of the scientific public.

—The annual meeting of the members of the Archaeological institute of America was held in Boston on the 19th ult., Prof. C. E. Norton, the president, in the chair.

The fourth annual report of the executive committee showed, that, since January, Mr. Bandelier has prosecuted his researches in New Mexico, steadily increasing the sum of knowledge concerning the number, the distribution, and the local peculiarities of the ancient Pueblos, and gradually accumulating the information upon which conclusions with respect to the mutual relations and the migrations of the various branches of the native stock, as well as to the limits of their civilization, may be safely based. In a letter dated San Juan, Arizona, April 9, Mr. Bandelier sketches the route which he proposes to follow, in order to trace the two streams into which he believes the main current of immigration to have been divided. First he will go, *vià* Georgetown, to Chihuahua and Casas Grandes, returning to Tucson. The second route will be southward from Tucson, through Sonora, Sinoloa, etc., to the City of Mexico. From the latter place he will follow the route of Cortés to Vera Cruz, and along the coast to Monterey. In this way Mr. Bandelier will have studied the whole of Mexico north of the 19th parallel. Should Mr. Bandelier be able to accomplish this proposed journey during the present year, one of the most important objects of the institute in the investigations intrusted to him will have been attained. A general survey of the Pueblo settlements, from their northern limit as far as the City of Mexico, will have been made by a competent observer, and many points hitherto in doubt, not only in regard to the Indians, but also concerning the early Spanish discoveries and settlement of the country, will have been determined.

Allusion was made to the celebration of the 333d anniversary of the settlement of Santa Fé, to be held in that place in July; and it was stated that a second edition of Mr. Bandelier's report upon Pécos, which was issued by the institute in 1881, had been prepared to meet a demand which had already come from that section of the country. Unfortunately, Mr. Bandelier's report upon the work done by him in Mexico in 1881 still remains unprinted, though about one-half is in type, owing to a lack of funds. Special contributions are solicited for this purpose. The report contains valuable information in regard to the great pyramid of Cholula, and the decorated houses of Mitla.

Work in Assos was stopped during January, but was resumed later, and the explorations pushed forward with energy in order to accomplish as much as possible before the expiration of the firman at the end of May. At that time nothing will remain to be done but to close the works, and divide the objects found with the Turks. Steps have been taken to obtain from the Turkish government the right to all

of the temple sculptures; and the Boston Museum of fine arts has appropriated two thousand dollars towards the purchase and transportation of antiquities, with the understanding that they shall become the property of the museum.

The different departments of the Assos work will be ably worked up by the several gentlemen in charge. The study and preparation of the inscriptions have been placed in charge of Dr. Sterrett, who has been connected during the past year with the school of classical studies which was established at Athens by the institute. The geology of the Troad will also be fully treated; and a large number of photographs of the site and the excavations, as well as of the objects found, has been made.

Mr. Clarke, in a letter dated April 4, gives an interesting account of recent finds, in the way of figurini (thirteen were found in one sarcophagus) glass, pottery, small bronzes, coins, etc. Besides this, excavations have been continued at the Agora, the west end of the Stoa, and on the fortifications. Moreover, Mr. Clarke has finished his second series of measurements of the temple, made with a heavy steel tape, which will be tested by some public standard to insure perfect accuracy in what will be one of the most important results of the expedition.

The second annual report of the committee of the American school of classical studies at Athens was presented as a part of the fourth annual report. From this it appears that the school has been successfully established, and carried through the first year of its existence, under the able management of Professor Goodwin. There have been seven regular members who have pursued definite subjects of investigations, the results of which will be embodied in theses which may be published in the bulletins of the school.

On Wednesday evenings, meetings have been held in the library, at which papers have been presented by the director or one of the members, and afterwards discussed; on Fridays, meetings were held for the study of Aeschylus and Thucydides; and on Saturdays, excursions were made to places of historic interest within easy reach of Athens.

During the year five colleges have joined the supporters of the school, the list of which now numbers fourteen; while several institutions which have been invited to join have not yet returned a definite answer. Next year Professor Packard of Yale will go out to take charge of the school, under the arrangement by which the supporting colleges send each year, in turn, a professor. The desirability of having a permanent official connected with the school is pointed out, and a strong appeal made for the creation of a special fund, which shall enable the committee to appoint such an officer.

After the reading of the report, a spirited and interesting account was given by Mr. Louis H. Aymé, U. S. consul at Merida, Yucatan, of his investigations in Central America, and of his plans for future work.

The most important business transacted at the meeting was the appointment of a special committee of consultation, to consider what steps could be taken to create and maintain an interest in the work of the institute in New York. They will report to the executive committee with a view to the establishment of a permanent committee to take part in the management of the institute.

The necessity of making constant appeals to the public for funds to carry on the work of the institute has led the executive committee to the resolve not to undertake any new work for the present, unless the money needed should be voluntarily contributed. The work already begun will be finished during the year; and for this purpose at least four thousand dollars above the amount to be counted upon from the annual fees will be needed.

The election of officers of the institute for the coming year resulted in the choice of the old board, with the exception of Mr. W. R. Ware, whose resignation was accepted, and for whom Mr. Stephen Salisbury, jun., of Worcester, was substituted.

— The annual meeting of the Society of arts of the Massachusetts institute of technology was held at the institute May 10. Mr. George F. Swain was unanimously elected secretary of the society for the year beginning Oct. 1, 1883. The following-named gentlemen were elected as members of the executive committee for the ensuing year: Mr. Jacob A. Dresser, Hon. F. W. Lincoln, Mr. Howard A. Carson, Mr. Waldo O. Ross, and Mr. C. J. H. Woodbury. Professor William H. Niles made a report of the work of the permanent meteorological committee of the society since its appointment about a year ago. The committee was formed at the request of the chief signal-officer of the United States to co-operate with the signal-service as far as possible in a general way, and especially to become acquainted with the workings and requirements of the service at the Boston station with the view to suggesting directions for increasing, if possible, its value and efficiency. The committee has found in Sergeant Cole a thoroughly competent head to this station. By recommendations to the chief signal-officer, the committee has been able to effect a material gain in the way of increased reports received at Boston, in the use of more powerful signal-lights for warnings at night, and in some other particulars. The committee has taken under consideration certain other proposed changes relating to the utility of the station in the city, and of the associated display-stations. Professor Niles deplored the present unfortunate impairment of the work of the signal-service through the failure of Congress to make the necessary appropriations. The number of morning reports received

at Boston has been cut down from seventy-seven to five, none of which are from stations west of New England. All the display-stations of the New-England coast have been closed, with the exception of one kept open by the Boston board of trade. The weather synopses have been discontinued, printing and telegraphing reduced, and salaries cut down. All the West-India stations have been closed; and thus, with the cyclone season upon us, we are without warnings which the country is abundantly able to provide. The report of the committee was accepted, and its members were requested to serve for another year.

Mr. J. C. Hoadley then gave an address on driven wells, explaining their action, comparing it with that of dug wells, and giving the results of his experimental investigations of the subject.

A vote of thanks was extended to the retiring secretary, Prof. S. W. Holman, and to Mr. Hoadley.

—At the meeting of the Philosophical society of Washington, May 19, Dr. Robert Fletcher presented a review of Recent experiments on venom poison, discussing especially the supposed antidote discovered in Brazil, and the separation of rattlesnake poison by Dr. Mitchell into three parts, two of which have definite and distinct toxic properties.

Mr. Farquhar, whose experiments in binary arithmetic have already been noticed in SCIENCE, gave an account of some additional experiments, confirming the conclusion that a binary notation may successfully compete with a denary for rapidity of arithmetic work, and showing that the ratio between the horizontal and vertical dimensions of the binary character has a material influence on facility of computation.

—A large company assembled in the rooms of the Cincinnati society of natural history on Wednesday evening, May 23, to celebrate the 176th anniversary of the birthday of Carl von Linné. The lecture-room was beautifully decorated with ferns and natural flowers, and mounted specimens of plants adorned the walls. The name of Linné in evergreens was placed above a beautiful miniature portrait of the great botanist, the frame of which was wreathed in smilax, while below was an autograph letter lent by a local collector. Three papers were read, on the life, the botanical and the zoölogical labors of Linné, by Mr. Davis L. James, Prof. A. P. Morgan, and Prof. Joseph F. James. After the reading, the audience was invited to the council-room, where an interesting microscopical *soirée* was held.

RECENT BOOKS AND PAMPHLETS.

Bate, J. Influence of the mind on mind. London, *Woolmer*, 1883. 696 p. 8°.

Bernhardi, Fritz. Das norddeutsche diluvium eine gletscherbildung, ein versuch, die richtigkeit der Forel'schen theorie aus der beschaffenheit und gestaltung unseres heimischen bodens zu erweisen. Züllichan, *Augustin*, 1883. 3+48 p. 8°.

Brown, T. T. Photometry and gas analyses. London, 1883. 8°.

Brown, Walter Lee. Manual of assaying gold, silver, copper, and lead ores. Chicago, *Jansen, McClurg, & Co.*, 1883. 318 p., illustr. 12°.

Burgess, J. Archeological survey of western India. iv., v.: Report on the Buddhist and Elura cave-temples. London, *Trübner*, 1883. f°.

Colquhoun, A. R. Across Chrysê: being a narrative of a journey of exploration through the South China borderlands, from Canton to Mandalay. London, *Low*, 1883. 2 vols., maps, 300 illustr. 8°.

Cramer, C. Ueber das bewegungsvermögen der pflanzen. Basel, *Schwabe*, 1883. 8°.

Fenton, H. J. H. Notes on qualitative analysis, concise and explanatory. London, *Cambridge Warehouse*, 1883. 128 p. 4°.

Fergusson, James. The Parthenon: an essay on the mode by which light was introduced into Greek and Roman temples. London, *Murray*, 1883. 8+135 p., 5 pl., illustr. 4°.

Galton, Francis. Inquiries into human faculty and its development. N.Y., *Macmillan*, 1883. 12+380 p., 6 pl. 8°.

Griffin, La Roy F. Lecture notes in chemistry: a syllabus of chemistry, compiled principally from the manuals of Miller and of Roscoe and Schoelemmer. Philadelphia, *Sower, Potts, & Co.*, [1883]. 6+99 p. 12°.

Houghton farm. Series III. Experiment department. No. 1-2. N.Y., *Dodge pr.*, 1883. 45 p., 4 pl. 8°.

Iowa state academy of sciences. Constitution and by-laws [including summary of transactions]. Des Moines, *Brewster pr.*, 1882. 24 p. 12°.

Joly, N. Man before metals. N.Y., *Appleton*, 1883. 8+365 p. 12°.

Kayser, H. Lehrbuch der spectral-analyse. Berlin, *Springer*, 1883. 11+358 p., illustr. 8°.

Keller, C. Das thierleben in grossen meerestiefen. Basel, *Schwabe*, 1883. 8°.

Kraepelin, Karl. Ueber die geruchsorgane der gliederthiere. Eine historisch-krit. studie. Hamburg, *Nolte*, 1883. 48 p., 3 pl. 4°.

Macloskie, G. Elementary botany, with student's guide to the examination and description of plants. N.Y., *Holt*, 1883. 8+373 p., illustr. 12°.

Müller, F. Max. India: what can it teach us? A course of lectures delivered before the University of Cambridge. London, *Longmans*, 1883. 11+402 p. 8°.

National academy of sciences. Constitution and membership, April 21, 1883. Washington, *Academy*, 1883. 24 p. 8°.

Ontario — Entomological society. Report for the year 1882. Toronto, *Robinson pr.*, 1883. 83 p. 8°.

Page, T. Physical geography of mountains and rivers; together with a general explanation of geographical terms. London, *Moffatt*, 1883. 80 p. 12°.

Palestine exploration fund. The survey of western Palestine. Memoirs of the topography, orography, hydrography, and archeology. Vol. 3. Sheets 17-26. London, *Fund*, 1883. 7+450 p. 4°.

Palmer, A. S. Folk-etymology: a dictionary of verbal corruptions or words perverted in form or meaning by false derivation or mistaken analogy. N.Y., *Holt*, 1883. 22+664 p. 8°.

Perrot, G., and **Chipiez**, C. A history of art in ancient Egypt. Translated and edited by Walter Armstrong. 2 vols. London, *Chapman & Hall*, 1883. 64+444, 16+426 p., illustr. l. 8°.

Pocket logarithms to four places of decimals, including logarithms of numbers and logarithmic sines and tangents to single minutes; to which is added a table of natural sines, tangents, and co-tangents. N.Y., *Van Nostrand*, 1883. 139 p. 16°.

Pressensé, E. de. A study of origins; or, the problems of knowledge, of being, and of duty. Translated by Annie H. Holmden. London, *Hodder & Stoughton*, 1883. 36+515 p. 16°.

Saunders, William. Insects injurious to fruits. Illustrated with 440 cuts. Philadelphia, *Lippincott*, 1883. 436 p. 8°.

Schleiden, M. J. The sciences among the Jews before and during the middle ages. From the 4th German ed. Baltimore, *Binswanger & Co.*, 1883. 64 p.

Stearns, Winfrid A. New England bird-life: being a manual of New England ornithology. Revised and edited from the manuscript of Winfrid A. Stearns, by Elliott Coues. Part 2: Non-oscine Passeres, birds of prey, game and water-birds. Boston, *Lee & Shepard*, 1883. 409 p. 12°.

Wagner, M. Untersuchungen über die resorption der calcium-salze und über die abstammung der freien salzsäure im magensaft, nebst einigen erörterungen über die pathogenese der rachitis. Zürich, *Füssli*, 1883. 8°.

PUBLISHER'S DEPARTMENT.

SCIENCE:

AN ILLUSTRATED WEEKLY

OWNED BY THE SCIENCE COMPANY.

DIRECTORS.

D. C. GILMAN . . . . . . PRESIDENT,
President Johns Hopkins University.

A. GRAHAM BELL . . VICE-PRESIDENT,
Inventor of the Telephone.

GARDINER G. HUBBARD,
Attorney and Capitalist.

OTHNIEL C. MARSH,
President National Academy of Sciences.

SAMUEL H. SCUDDER,
President Boston Society of Natural History.

TERMS.

SUBSCRIPTIONS.— $5 a year in United States and Canada; $6 a year in all other countries.

SINGLE COPIES.— 15 cents each.

ADVERTISEMENTS.— $60 a page, each insertion; parts of pages in proportion.

CIRCULATION.— Never less than 6,000 copies a week; oftentimes ranging from 6,000 to 10,000 a week.

PUBLICATION DAY.—"Science" is published every Friday. To insure insertion in current week, all matter must reach Cambridge on Monday morning.

CORRESPONDENCE.— Address all communications relating to contents of the paper proper to "Editor of 'Science,' 19 Brattle Street, Cambridge, Mass.," and all business correspondence to the undersigned.

MOSES KING, *Publisher*,
P. O. Box 24. CAMBRIDGE, MASS.

THE FIRST VOLUME.

On the twenty-ninth day of June the current volume of "Science" will close. Its index will be sent out a few weeks later. The observer will then notice that in the twenty-one issues comprising Vol. I. there were printed 620 pages of text, apart from every variety of advertising. These pages will make, when bound, a handsome and peculiarly valuable book, the money-value of which will increase from year to year. As to their quality, it may be said that the contents have been the work of more than a hundred scientific men, many of whom are eminent representatives in various departments of science. As to their quantity, it may be said that the unpretentious weekly issues of "Science" contain in one year a greater volume of matter than any similar periodical published anywhere in the world; more, too, than such large magazines as "Harper's" and "The Century."

It is this ample supply from eminent writers that is to be the paramount feature of the successive volumes of "Science," and the feature that will sooner or later, it is hoped, cause the journal to be cheerfully subscribed to certainly by every scientific person and institution, and probably by a large percentage of the most intelligent class of people throughout the world.

But few journals have met with greater success than has "Science" in its short career; and persons who had subscribed merely to encourage the enterprise have since expressed themselves as so much interested in its contents as to continue to take "Science" so long as it maintains its present standard.

THE FIRST NUMBER.

No. 1 of Vol. I. is getting to be a scarce number, and the publisher is willing to allow twenty-five cents for it to any one who has it and desires to subscribe for the first year; that is, any one wanting "Science" for its first year, excepting No. 1, may remit only $4.75 instead of $5.00. The publisher is also willing to give two copies of any other number for one copy of No. 1. Subscribers having duplicate copies of No. 1, without any special use for them, will be kind enough to return them to the publisher, who, in return, will send at the rate of fifty cents each for them, payable in extra copies of "Science."

BOOKS WANTED.

Scientific men wanting valuable or rare scientific books will probably be able to secure them by advertising in "Science."

BOOKS FOR SALE.

A special feature will soon be made in "Science" by having in each issue the advertisement of rare and valuable books wanted or for sale. Persons having books for sale will do well to correspond with the publisher of "Science" to ascertain terms.

BINDERS FOR "SCIENCE."

There is no better way to take care of periodicals than to place them, as soon as their regular issues arrive, in one of the many good patterns of temporary binders. Moses King, the publisher of "Science," has had made up a small lot of excellent binders, having neat and appropriate lettering, and capable of holding the issues for a whole year. These binders are sent, postpaid, to any address, on receipt of one dollar.

SCIENTIFIC WORKERS.

There ought to be no better means for institutions to secure instructors and assistants in scientific branches than by briefly making their wants known in this journal, which now circulates at every scientific and educational institution of any prominence at all throughout America.

SITUATIONS WANTED.

Private tutors, professors, instructors, assistants, and others seeking employment in any department of science, will unquestionably find it to their interest to make an announcement of their wants in the columns of "Science."

SCHOOLS AND COLLEGES.

No better medium can be found for announcing schools, colleges, universities, and other educational institutions, than the columns of "Science," the regular edition of which never falls short of six thousand copies *every week*, and at times rises to fully ten thousand copies a week. We make specially low rates to institutions of this class.

AN ACCOMMODATION TO SUBSCRIBERS.

Subscribers who may at any time desire to send a copy, or perhaps several copies, of any number of "Science," to their acquaintances or correspondents, need send us merely the addresses to which they are to be sent, and payment at regular prices, and we will send the copies at our cost of postage directly from the "Science" office, without any further trouble on the part of the subscribers.

SCIENCE DIRECTORY

OF

'rustworthy firms dealing in or manufacturing apparatus, books, and other goods required by persons ngaged in scientific and literary work.

The publisher has carefully made up this directory, and inserts the name of no firm that he has ny reason to believe is not wholly trustworthy in every articular. Any subscriber or reader of "Science" whoever experiences any difficulty with one of these rms will greatly oblige the publisher by notifying im of the fact, so that the firm's name may immeiately be taken from this Directory.

It may be taken for granted that any firm herein ientioned will promptly and carefully send all desired iformation — with catalogue and circulars, whenever ssued — to any person who mentions this paper in pening the correspondence.

MOSES KING, Publisher of "Science,"
CAMBRIDGE, MASS.

Albertypes and Lithographing.
'ORBES COMPANY, 181 Devonshire St., Boston.

Amateur Photograph Outfits.
3LAIR TOUROGRAPH Co., 471-475 Tremont St., Boston.

Electrical Supplies and Test Instruments.
ELECTRICAL SUPPLY Co., 17 Dey St., New York.

Illustrations and Drawings.
'HOTO-ENGRAVING Co., 67 Park Place, New York.

Photo-Engraving and Designing.
'HOTO-ENGRAVING Co., 67 Park Place, New York.

MISS M. W. FROTHINGHAM, Copyist, No. 28 School Street, Boston, Room 44. Documents of all kinds promptly and accurately opied. Manuscript revised. Use Elevator.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.
Engraver on Wood. References: American team Gauge Co., Boston Journal of Commerce.

BROWN BROTHERS & CO.,

59 WALL STREET, NEW YORK,

SSUE COMMERCIAL AND TRAVELLERS' CREDITS

For use in this country and abroad.

DAKOTA.
Trustworthy information given and safe nd lucrative investments made for non-residents in this most prosperous region.
NEW YORK REFERENCES.—Horace White; eorge S. Morrison. BOSTON REFERENCES.—ower, Giddings & Co.; Henry F. Coe. SALEM EFERENCE.—David Pingree.
ALDEN & WATERS, Land Agents,
JAMESTOWN, DAKOTA.
John A. Alden. Clifford C. Waters.

SULLIVAN BROTHERS & LIBBIE,

AUCTIONEERS.

SALESROOM . . No. 2 BEACON STREET,

BOSTON, MASS.

Special facilities for the display and sale, by ction, of private libraries (large or small), utographs, coins, paintings, engravings, works f art, furniture, fancy goods, etc. Catalogues nt to, and orders executed for, librarians and ookbuyers gratis.

Johns Hopkins University,

BALTIMORE, MARYLAND.

Collegiate and University Courses.

Announcements for 1883-84 will be sent on application.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

Regular four-year courses in Civil, Mechanical, and Mining Engineering, Architecture, Chemistry, Physics, Natural History, etc. Students are also admitted to partial or special courses. School of Mechanic Arts for instruction in English, French, Drawing, Mathematics, and Shopwork. Next school-year begins Sept. 24, 1883. Entrance examinations Sept. 18 and 19, at 9 A. M.
WEBSTER WELLS, Secretary.
FRANCIS A. WALKER, President.

DE VEAUX COLLEGE,
Suspension Bridge, N. Y., prepares for the universities, etc. Terms $350 per annum.
WILFRED H. MUNRO, A. M., President.

MRS. PIATT'S SCHOOL FOR YOUNG Ladies. Utica, N. Y. The next school-year begins Wednesday, Sept. 19, 1883. Applications should be made early.

MISS ANABLE'S BOARDING AND DAY SCHOOL FOR YOUNG LADIES.
1350 PINE STREET, PHILADELPHIA, PENN.
The thirty-fifth year begins Sept. 19, 1883.

THE MISSES ANABLE'S ENGLISH AND French Boarding and Day School for Young Ladies, 13 Livingston Avenue, New Brunswick, N. J. One hour from New York, and an hour and a half from Philadelphia, on the Pennsylvania Railroad. French under the care of a resident teacher from Paris. Music in charge of professors from New York. The school will open Sept. 12. Please address

MISS H. I. ANABLE,
1350 PINE STREET, PHILADELPHIA, PENN.

FLORIDA UNIVERSITY,
TALLAHASSEE, FLA.
Medical Department. Tallahassee College of Medicine and Surgery. Term of 1883-84 begins Nov. 20, 1883. Address J. KOST, Dean, Adrian, Mich., till October, then Tallahassee, Fla. W. P. BYRD, TALLAHASSEE.

CUSHING ACADEMY,
Ashburnham, Mass.
A first-class College-Preparatory and English School for both sexes. Expenses, $150 to $225 a year. Ninth year begins Sept. 5. Send for a Catalogue.
JAMES E. VOSE, Principal.

SHORT-HAND WRITING
taught through the mail. Standard system, capable instruction, reduced terms.
F. G. MORRIS,
Easthampton, Mass.

JNO. A. BRASHEAR,
MANUFACTURER OF
Silvered Glass, Reflecting Telescopes and Specula. No. 3 Holt Street, head of 22d, south side, PITTSBURGH, PENN.

CHARLES WILLIAMS, JUN.
(Established 1856.)
109 AND 115 COURT STREET, BOSTON, MASS.
Manufacturer of
TELEGRAPHIC, ELECTRICAL AND MAGNETICAL APPARATUS.

Call-Bells, Annunciators, Telegraph Instruments, Batteries, Medical Machines, Office, Annunciator, Silk and Cotton Covered, and Line Wire, Insulators, Brackets, etc. Telegraphic, Telephonic, and Electrical Material of all kinds.

SCIENTIFIC LIBRARY FOR SALE.
Includes fifty-six consecutive volumes of "American Journal of Science," to date, the first six volumes of "Nature," the first six volumes of "Journal Iron and Steel Institute of Great Britain," "Percy Wedding Metallurgie," and many other valuable books and periodicals relating to chemistry and technology. List on application. D. FISHER,
112 HURON STREET, MILWAUKEE, WIS.

THE NEW BOTANY.
A lecture on the best method of teaching the science. By W. J. BEAL, M.Sc., Ph. D., Professor of Botany in Agricultural College, Lansing, Mich. Second edition. 8vo, paper. Mailed, postage free, for 25 cents. Send for circular and book list free. Address,
CHARLES H. MAROT, PUBLISHER,
814 Chestnut Street, Philadelphia.

D. VAN NOSTRAND'S

NEW CATALOGUE.

SCIENTIFIC BOOKS.

Send ten cents for a *new* and *enlarged* descriptive catalogue. Octavo. 96 pages.

D. VAN NOSTRAND, PUBLISHER,
23 Murray Street, New York.

B. WESTERMANN & CO.
[Established 1848].
838 Broadway, . . . New York.
Importers and Booksellers of Foreign Books. Weekly Importations from all parts of Europe.

THE NATION.

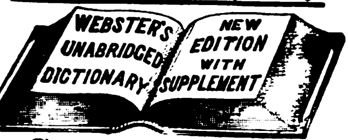
EIGHTEENTH YEAR.

Size recently enlarged to twenty-four pages, and PRICE REDUCED TO $3 PER YEAR.
Sample copies sent on request. Address the PUBLISHER, 210 BROADWAY, NEW YORK.

A USEFUL BOOK.
For the benefit of ladies who use knitting silk, the Nonotuck Silk Company have carefully prepared a book entitled "How to use Knitting-Silk." It is full of new engravings, and handsomely printed. Sent on receipt of three two-cent stamps.
NONOTUCK SILK Co., Florence, Mass.

HENRY C. DIMOND & CO.,
Manufacturers of and dealers in Self-Inking Stamps, Rubber and Metal Stamps of all kinds. Ribbon Stamps, Seal Presses, Inks, Ribbons, Seals, Dies, etc. Repairing a specialty.
22 Milk Street, Boston, Mass.

WEBSTER.
In Sheep, Russia and Turkey Bindings.



Get the Standard.

GET Webster—it has **118,000 words, 3000 Engravings,** and a **New Biographical Dictionary.**
THE Standard in Gov't Printing Office, **32,000** copies in Public Schools. Sale **20** to **1** of any other series.
BEST aid to make a **Family** intelligent. **Best help for SCHOLARS, TEACHERS** and **SCHOOLS.**
It is the best practical English Dictionary extant.—*London Quarterly Review.*

"It has all along kept a leading place, and the new edition brings it fairly up to date."—*London Times, June,* 1882.

"It has come to be recognized as the most useful existing 'word-book' of the English language all over the world."—*N. Y. Tribune,* 1882.

☞ The Vocabulary contains 3,000 more words than are treated in any other American dictionary.

G. & C. MERRIAM & CO., Pub'rs, Springfield, Mass.

SCIENCE appears every Friday. Volumes begin in July and January To insure publication in current week, all matter must reach Cambridge on Monday Terms, $5 00 a year in United States and Canada; $6.00 a year in foreign countries Single copies, 15 cents. Advertising rates sent on request. Address all correspondence and contents of paper to "EDITOR OF SCIENCE, Cambridge, Mass.," and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

HORSFORD'S

ACID PHOSPHATE,

(LIQUID.)

For DYSPEPSIA, MENTAL and PHYSICAL EXHAUSTION, NERVOUSNESS, WAKEFULNESS, DIMINISHED VITALITY, etc.

Prepared according to the directions of Professor E. N. Horsford, of Cambridge, from the phosphates of lime, magnesia, potash, and iron, with phosphoric acid in such form as to be readily assimilated by the system.

UNIVERSALLY PRESCRIBED BY PHYSICIANS.
IT IS NOT NAUSEOUS, BUT AGREEABLE TO THE TASTE.
NO DANGER CAN ATTEND ITS USE.
ITS ACTION WILL HARMONIZE WITH SUCH STIMULANTS AS ARE NECESSARY TO TAKE.
IT MAKES A DELICIOUS DRINK WITH WATER AND SUGAR ONLY.

Prices reasonable Pamphlet mailed free.

RUMFORD CHEMICAL WORKS, Providence, R. I.

JACKSON · THE HATTER,

No. 59 TREMONT STREET, BOSTON.

For a long series of years Jackson, the Boston hatter, has most satisfactorily supplied the best classes of New England people with all those goods usually to be had at first-class hat-establishments.

Very many subscribers to "Science" and the most highly esteemed professors, merchants and financiers, are patrons of Jackson.

Students in Universities and preparatory schools are always to be found at

JACKSON'S HAT-STORE, 59 Tremont St., Boston.

THE

UNITED STATES

PHOTO-ENGRAVING CO.,

No. 7 MURRAY STREET,

NEW YORK CITY.

Engravings for Books, Pamphlets, Catalogues, etc., made at prices far below the cost of wood-engraving.

We send free, to any address, specimens of our work, showing them to be admirable engravings for all purposes of fine or ordinary illustration. Address

United States Photo-Engraving Co.,

No. 7 MURRAY ST., NEW YORK.

WATERS'S FLESH-BRUSH.

The brush is made of vegetable fibre, with a due amount of anim[al] fibre upon one side, making a positive and negative electrical surf[ace] and practically a double instrument. The material is so disposed, [that] when in use, a firm looped fibre is brought in contact with the surfa[ce] be acted upon, instead of the ends of bristles, as in the old brush, [giving] it great detergent power. It assists in restoring to and preserving health by quickening the surface circulation, relieving internal [conges]tions, freeing the pores of the skin, and promoting their fun[ctional] activity, in that way relieving the blood of much clogging, effete ma[tter] that would otherwise oppress the circulation, and might injure the l[iver] and kidneys in passing from the body, possibly producing Bright's [dis]ease or consumption.

A proper daily use of this brush helps all the organs of the [sys]tem towards a healthy activity. It will be sent free of expense to [any] address, *with full directions for use*, worth more to any one than [the] price of the brush, on receipt of three dollars. The brush, without [the] animal fibre, is sold for two dollars. Liberal terms to the trade on app[li]cation to the proprietor.

G. F. WATERS,

8 BEACON STREET, ... BOSTON, MASS.

THE FORBES LITHOGRAPHING AND ENGRAVING ESTABLISHMENT IS THE LARGEST OF ITS CLASS IN AMERICA.

—THE—

FORBES COMPANY,

181 Devonshire St., Boston,

Have unsurpassed facilities for every variety of

LITHOGRAPHING, PRINTING,

ALBERTYPING,

COLOR-WORK, ENGRAVING,

AND

PHOTO-LITHOGRAPHY.

This Company is prepared to do all the work in plain or c[olor] printing ever required for books, periodicals, pamphlets, c[ircu]lars, catalogues, illustrations, etc.

THE FORBES CO., BOSTON

FRIDAY, JUNE 15, 1883.

DARWIN.

I.

HE was a bold discoverer of the wise
And lucid order of the world, who bade
Men love the truth and speak it, and be glad
When each ideal of superstition dies.

The bigot cursed him, and, with flaming eyes,
Flashed hate upon him as on one gone mad
With stark God-enmity, although he had
No blacker sin than honest hearts devise.

He was a hero for the right of men
To seek beyond their bibles, churches, creeds,
Beyond the rigid will of pope or priest,

Thought buried deep in nature; holy when
Revealed to us by any soul that reads
The infinite mind in God and man and beast.

II.

Amid the hard endeavor of old days,
He strove supremely, and, with patient will,
Climbed masterfully onward, upward, till
He rose above men's bitter blame or praise.

He probed our life along its secret ways,
Back through historic centuries, farther still.
He traced the simple, clear designs which fill
Creation as they fill a robin's lays.

Within the vast complexity of forms,
Births of one primal ancestry he saw,
Like stars and planets from one chaos hurled,

And showed, through aeons of fire and flood and storms,
The march of evolution and of law,
The beauty and the wonder of the world.

III.

Ah! we could only listen when he told,
How, through the antique ages to the new,
Life from a barbarous toil and struggle grew,
Like a staunch creeper from an arid mould;

How savage instinct in the strong and bold
Crushed out the weak, and how the mightier few
Roamed in their wild blood-thirstiness, and slew
The fierce-fanged slayers that had been kings of old.

He pictured to our eyes the carnal strife,
The eternal woe and pathos of the earth,
And awful brooding death which makes us mute:

And thus he spoke the story of our life,
The growth of mind from some tenebrious birth,
The soul of man developed from the brute.

IV.

Since he has lived, our human thought has gained
Fresh wings and ampler airs. His courage broke
The serfdom of tradition, and awoke
New visions of a freedom unrestrained.

He was our modern prophet. Truth remained
As fruit of all the burning words he spoke;
And, seeing with his strong eyes, our dreams evoke
A future which shall be at last attained.

He shaped our way, and we shall follow. Time
And hope are with him and with us to-day;
And out of sky and sunlight and the dark

Shall come a knowledge radiant and sublime,
And song, whose music will not pass away,
Triumphant as the singing of the lark.

GEORGE EDGAR MONTGOMERY.

RECENT EXPLORATIONS IN THE REGION OF THE GULF STREAM OFF THE EASTERN COAST OF THE UNITED STATES BY THE U. S. FISH-COMMISSION.[1]

3. Influence of the Gulf Stream.

THE bottom along the upper part of this slope and the outermost portion of the adjacent plateau, in 65 to 150 fathoms, and sometimes to 200 fathoms or more, is bathed by the waters of the Gulf Stream. Consequently the temperature of the bottom water along this belt is decidedly higher than it is along the shallower part of the plateau, nearer the shore, in 30 to 60 fathoms. The Gulf Stream itself is usually limited in depth to about 150 fathoms, and often even less, in this region; below this the temperature steadily decreases to the bottom of the ocean-basin, becoming about 38°–37° in 1,000 to 1,500 fathoms, and falling to 37°–35° in 1,500 to 2,500 fathoms. We may, therefore, properly call the upper part of the slope, in about 65 to 150 fathoms, the warm belt. According to our observations, the bottom temperature of the warmer part of this belt, in 65 to 125 fathoms, is usually between 47° and 53° F. in summer and early autumn. Between 150 and 200 fathoms the temperatures, though variable, are usually high enough to show more or less influence from the Gulf Stream. On the warm belt we took numerous kinds of animals that were previously known only from the Gulf of Mexico or the Straits of Florida. Some belong to tribes that have always been considered as tropical or subtropical, such as Dolium, Marginella, and Avicula, among the shells. In

[1] Continued from No. 16.

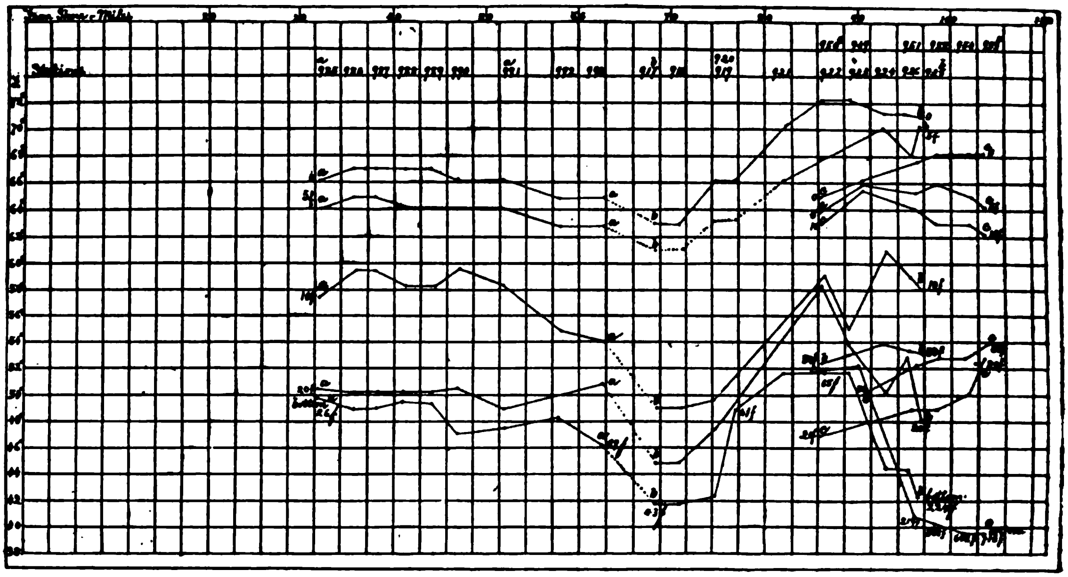


DIAGRAM 2. — Temperature curves at the surface and bottom, and at the intermediate depths of 5, 10, 20, 30, and 50 fathoms, arranged according to the distance, in miles, from the shore. The observations were made on three different days, as indicated by the letters *a–a*, *b–b*, *c–c*. The dotted lines indicate breaks in the actual series of observations.

fact, this belt is occupied by a northern continuation of the southern or West Indian Gulf Stream fauna. Our observations, both on the animal life and the temperature, demonstrate that the western edge of the Gulf Stream is much nearer this coast than it is located on most modern charts. According to our experience, the influence of the Gulf Stream becomes decidedly marked by the rise in temperature at a few fathoms below the surface.

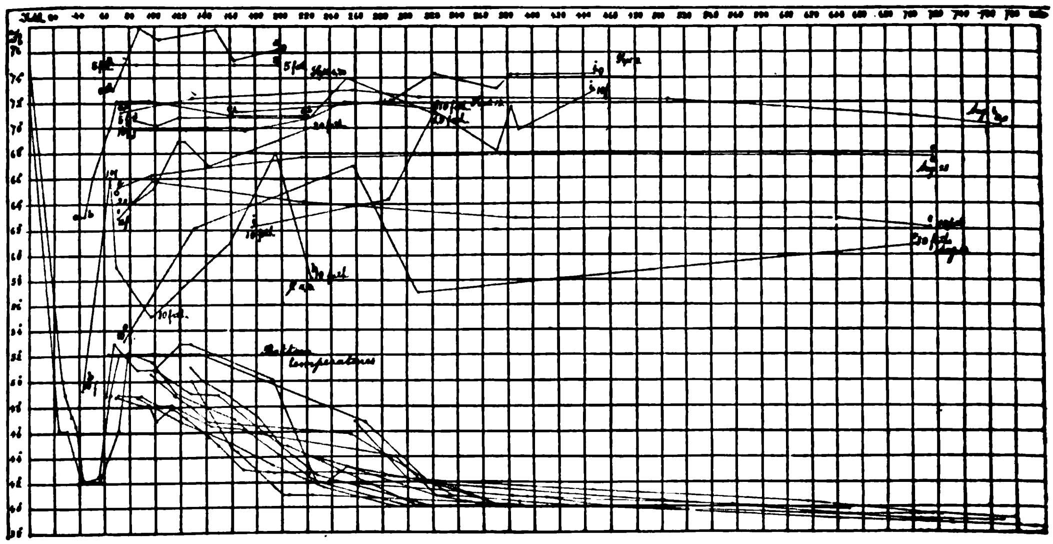


DIAGRAM 3. — Temperature curves at the bottom and surface (*o*), and at 5, 10, and 20 fathoms in the same localities. The curves of bottom temperatures extend from the shore to near the 800-fathom line on the Gulf Stream slope. The position of each station is indicated by the total depth placed at the head of the vertical columns.

and also at the bottom, along a belt corresponding nearly with the 65-fathom line in summer. This is shown both by the abundant occurrence of the various pelagic animals, gulf-weed, etc., characteristic of the Gulf Stream water farther south, and by the temperatures taken by us. The diagrams of temperature curves in 5, 10, 20, 30, and 50 fathoms, all illustrate this, as well as those of the surface and bottom. The recent English admiralty charts, and others, place the inner edge of the Gulf Stream, in summer, entirely outside the slope, or 40 to 50 miles farther from the coast than we have found it in this region. In summer, as is well known, the Gulf Stream is noticed nearer the coast than in winter; but this, doubtless, applies strictly or chiefly only to the surface water. But in summer, owing to the heat of the sun, there is often very little difference between the temperature of the *surface water* at the Gulf Stream and on the in-shore plateau. Our investigations show that the warm belt, in 65 to 125 fathoms, is inhabited by a peculiar southern fauna that could not exist there if the Gulf Stream did not flow along this area at the bottom, both in winter and summer. It is evident that what many of these species require is *not a very high*, but a *nearly uniform temperature* all the year round. Such an equable temperature could not exist in this region, except under the direct and constant influence of the Gulf Stream. On the lower part of the slope, in 300 to 780 fathoms, we found numerous arctic forms of life, corresponding to the lower temperature, which, at 300 to 500 fathoms, is usually 41° to 40° F.; and, at 500 to 1,200 fathoms, 40° to 38° F. On the in-shore plateau, which is occupied by a branch of the cold arctic current, about 30 miles wide, we found that the temperature of the bottom water usually varied from 46° to 42° F. in August, at the depths of 30 to 60 fathoms. In some instances it was higher than this nearer the shore, and especially opposite the mouths of the bays and sounds, where the tidal flow rapidly mingles the warm surface water (70° to 75°) with the bottom water. On the cold part of the shore-plateau we also found an abundance of arctic species of animals, such as are found at similar and less depths north of Cape Cod and in the Bay of Fundy. During the colder season of the year, the temperature of the water over this plateau is decidedly lower; for codfish, even, are taken here in large numbers in winter. This plateau, especially over its shallower portions, has, therefore, a *variable cold climate*. But the deep water, below 300 fathoms, has a *uniformly cold climate*. It is evident that the warm belt is here a comparatively narrow zone along the bottom, wedged in between the cold waters of the in-shore plateau and the still colder waters that cover the outer and deeper part of the Gulf Stream slope. The actual breadth of this warm belt varies, however, according to the steepness of the slope, and in consequence of variations in the currents. Just south of Martha's Vineyard, as will be seen by map I, the slope appears to be less rapid than it is either to the eastward or southward, and consequently there is here a broader area occupied by the warm belt,

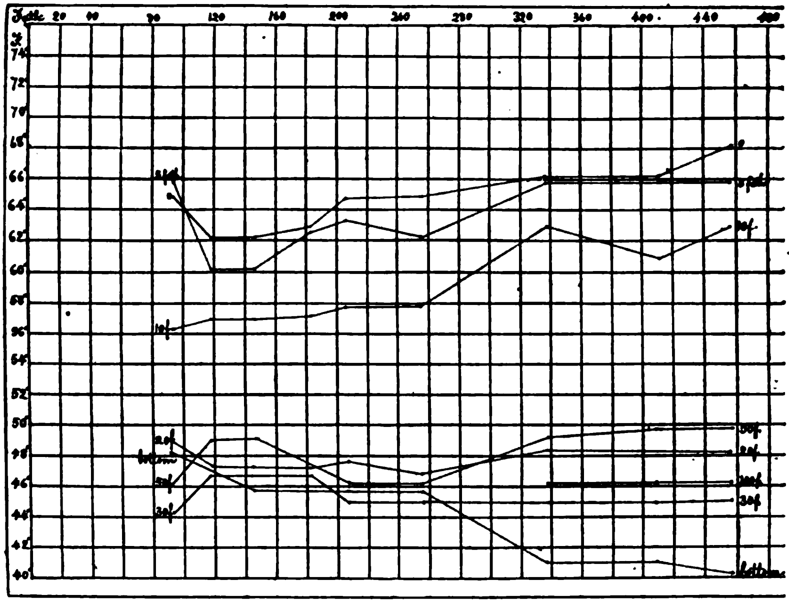


DIAGRAM 4. — Temperature curves at the bottom and surface (*o*), and at the intermediate depths of 5, 10, 20, 30, 50, and 100 fathoms. These observations were all made Sept. 14, 1881. This illustrates the rise in temperature between 30 and 50 fathoms from the surface.

especially between the 65 and 150 fathom lines. Probably this warm belt finally narrows out and disappears from the bottom before reaching the coast of Nova Scotia. We have hitherto obtained no evidence of such a belt off that coast from temperature observations and the character of the fauna; therefore it is probable that the cold water of the greater depths there mingles directly with that of the in-shore plateau. Southward, the warm belt continues to the Straits of Florida, and beyond, the depth of the water characterized by identical temperatures gradually increasing as we go south. At Cape Hatteras this belt becomes very narrow, owing to the abruptness of the slope, and approaches much nearer to the shore; but off the Carolina coasts it spreads out over a wide area, which is inhabited by a rich fauna, similar to that investigated by us off Martha's Vineyard. Many of the species are already known to be identical.

In the following summary table are shown the usual range of variation, and the approximate average temperature at the bottom, in the more characteristic zones of depth, beyond 20 fathoms, in summer: —

Bottom temperatures.

Fathoms.	Usual range.	Approximate average.
20 to 25	45°–51° Fah.	49° Fah.
25 to 58	42°–46° "	44° "
65 to 130	47°–53° "	50° "
65 to 150	46°–53° "	49.5° "
65 to 190	43°–53° "	48.5° "
150 to 200	43°–50° "	47° "
200 to 300	41°–46° "	43° "
300 to 450	40°–42° "	40.5° "
450 to 600	40°–41° "	40° "
600 to 800	39°–40.5° "	39.5° "
800 to 1,400	38°–39° "	38.5° "

[From this table, and from the diagrams (2 and 3), a few of the published temperature observations, which were abnormally high, have been excluded, because they were probably erroneous, owing to a displacement of the index, or some other accident.]

A singular feature of the serial temperatures taken at many stations is illustrated by diagrams 3 and 4. In twenty-nine localities out of thirty-six, where sufficiently full series of temperatures were taken, the temperature was lower at 20 to 30 fathoms than at 50 fathoms. Usually the temperature falls pretty regularly from 5 to 30 fathoms; it then rises often three or four degrees, and sometimes eight to ten degrees, at 50 fathoms, falling again at 100 fathoms; but the temperature at 100 fathoms was often higher than at 30 fathoms. In some cases, as shown in diagram 4, the temperature was lower (45° F.) at 30 fathoms than even at the bottom in 200 to 250 fathoms. There is often, therefore, a stratum of colder water, 20 to 40 fathoms beneath the surface, overlying the warmer Gulf Stream water, situated between 50 and 100 fathoms, below the surface in this region. This stratum of cold water may be a lateral extension of the cold water of the in-shore plateau, situated at similar depths. Perhaps the greater density of the Gulf Stream water, due to evaporation, may so nearly balance the increase in density due to lower temperature as to make this a phenomenon of constant occurrence at these depths.

It happened not infrequently that the surface temperature, early in the morning, when we usually began dredging, was one or two degrees lower than that at 5 fathoms, but, during the middle of the day, the surface water was generally slightly warmer than that at 5 fathoms. These changes are illustrated by some of the lines on diagrams 3 and 4.

[*To be continued.*]

TRANSFERRED IMPRESSIONS AND VISUAL EXALTATION.

THERE has recently appeared in the *Fortnightly review* an article by Messrs. Edmund Gurney and F. W. M. Myers, regarding the subject of what is popularly known as *clairvoyance*. By these authors it is termed 'transferred impression.' The gentlemen in question, working under the auspices of the Society for physical research, have, as they claim, collected an enormous amount of evidence, all tending to prove that the mind can, under certain conditions, receive impressions through other agencies than the senses. The mental conditions under which this power is developed are generally abnormal, either as regards the Percipient or the person perceived, who is called the Agent. The cases are classified in accordance with this condition. I append here a specimen of the stories which these gentlemen attest as true.

"A mesmerist, well known to us, was requested by a lady to mesmerize her, in order to enable her to visit in spirit certain places of which he himself had no knowledge. He failed to produce this effect, but found that he could lead her to describe places unknown to her, but familiar to him. Thus, on one

occasion he enabled her to describe a particular room, which she had never entered, but which she described in perfect conformity with his recollection of it. It then occurred to him to imagine a large open umbrella as lying on a table in this room, whereupon the lady immediately exclaimed, 'I see a large open umbrella on the table.'"

Now, the facts which these gentlemen are trying to establish are entirely antagonistic to modern physiological views, as I have written elsewhere (*New-York medical record*). It is now believed that the senses were developed in order to enable the animal to adjust itself better to its environment. They were evolved primarily *by* the environment rather than *for* it. And in the history of animal evolution there are absolutely no data to enable us to account for the existence of super- or extra-sensory perceptive powers. If such powers do exist, we must seriously alter our views of evolution as regards physiological functions. Their existence is therefore antecedently most improbable, and the evidence for the same demands the most rigid scrutiny. So far, it by no means carries conviction. Messrs. Gurney and Myers give us specimen stories which are, for a large part, told by women, or even by children. Some of them are legendary, the incidents dating back a century. The authors, perhaps, allow for unconscious exaggeration, but it does not appear so. They certainly do not, in their estimate, allow for the element of coincidence. Thousands of 'impressions, dreams,' etc., occur daily: we only hear of those which appear to be true.

Finally, and it is this point which I especially wish to bring out, the London quasi-scientists do not appear to be aware that there is most likely such a thing as an enormous exaltation of the sense of vision. This possibility ought certainly to be taken into account in studying the class of phenomena under consideration.

As evidence of this power of visual exaltation, I beg to relate the following experiment: —

In the summer of 1881, the late Dr. George M. Beard, Dr. William J. Morton, editor of the *Journal of nervous and mental diseases*, of this city, and myself, called by appointment upon a Mr. Carpenter, who was a professional mesmerizer, then stopping in this city. Our object was to test the alleged power of Mrs. Carpenter, his wife, to read and see objects when blind-folded. Mr. Carpenter was a man of much intelligence, and, I believe, honest, though necessarily using a little humbug to give more effect to his dramatic performances. He knew perfectly well that mesmerism was merely a morbid psychological condition, not involving any occult force. His wife was a lady of about thirty years of age, of very pleasing appearance, intelligent, refined in manner, and evidently of a highly sensitive organization. She was easily susceptible to her husband's influence, and could be hypnotized by him. In the hypnotic condition, at certain times, her visual sense appeared to be enormously exalted. Dr. Beard had, on several occasions, under suitable tests, seen her read cards with eyes closed and bandaged. Sometimes, however, she had failed.

On the present occasion we were ushered into the large back-room of a New-York boarding-house, Mrs. Carpenter and her husband being the only persons present besides ourselves. It was broad daylight, and there was no attempt to darken the room. Mr. Carpenter hypnotized his wife so that, while perfectly conscious of every thing, she could not open her eyes. Her eyes were then bandaged with four handkerchiefs. Two were folded, and laid as pads over each eye; the others were tied around the head. In addition, a strap was tied around just below the nose. (I have bandaged my own eyes in this fashion, and found that I could not distinguish light from darkness.) Mrs. Carpenter was placed in a chair at one end of the room. Mr. Carpenter's eyes were then bandaged, and he was placed at the other end of the room, so as to prevent any possible collusion. A pack of cards which had been brought by Dr. Beard was shuffled, and placed, with faces down, upon a table beside Mrs. C. One of us then took a card, and handed it to her. She held it in one or both hands before her eyes, sometimes pressing it upon her forehead. No questions were asked by any one. Her husband remained silent. She would first tell the color (red or black), then the kind (diamonds, spades, etc.), then the number of spots. Sometimes she did it quickly, sometimes slowly: occasionally she failed. Sometimes she could only tell the denomination, and could not count the spots. Dr. Morton had brought in his pocket a private dinner-card with 'B. No. 9' printed upon it. No one but himself had ever seen it in his possession before. Mrs. C. took this in her hand, and read it. The picture-cards were sometimes distinguished also. The letters and figures looked, she said, much magnified. It generally required several seconds

for the impression to be created. In some cases, after she had held the card for sometime and failed to read it, she laid it down, took up another, and called it by the name of the card laid down, showing that the impression from it had just been received. Any entirely opaque object placed between her eyes and the card prevented her reading it. She could not see objects to one side of the range of her eyes; e.g., behind her head.

All the phenomena seemed to point to the theory that she had an extraordinary exaltation of vision rather than any extra-sensual power, and I am at present inclined to adopt this explanation.

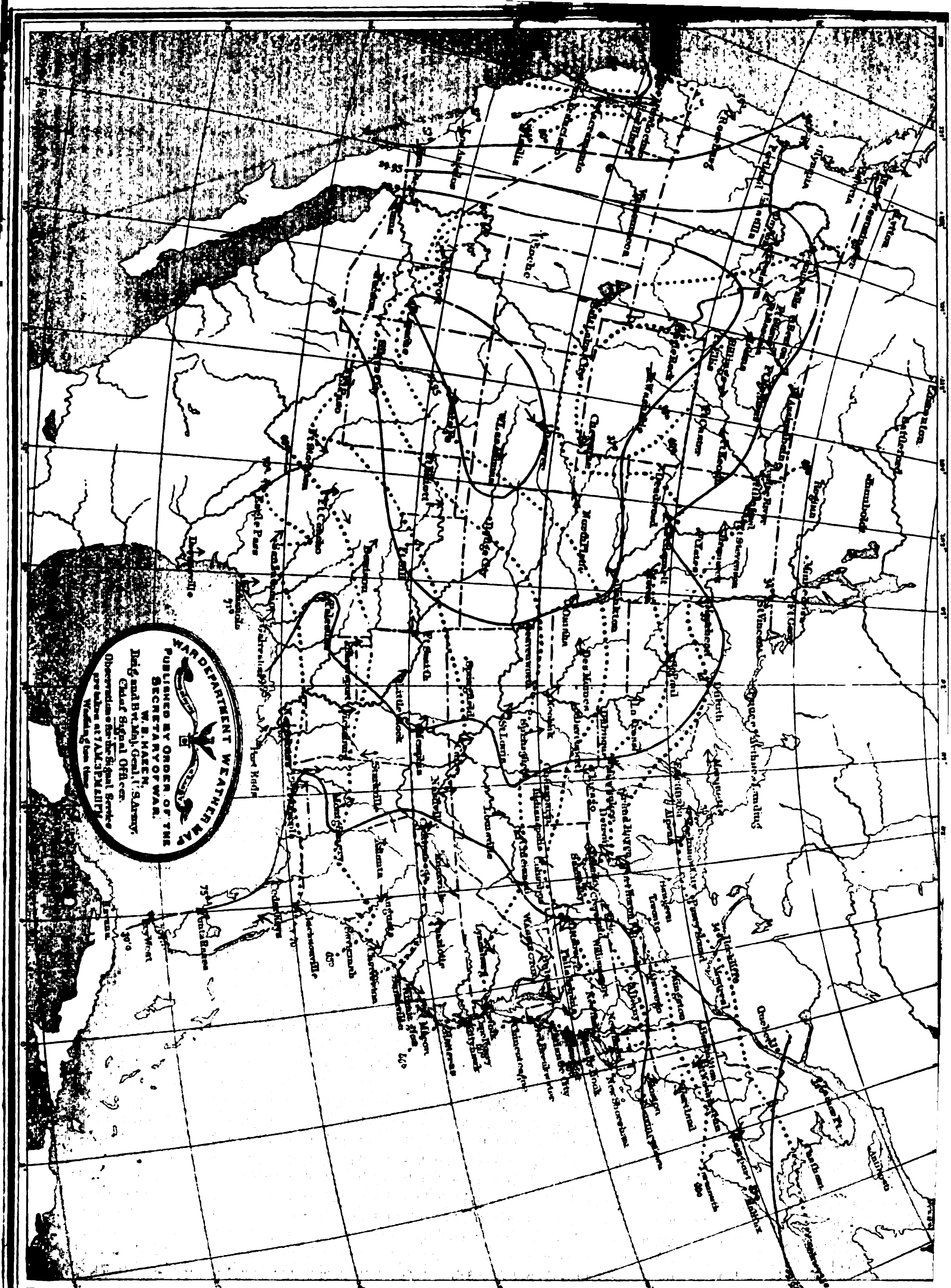
I have not been able to repeat this experiment. Mr. Carpenter refused to allow his wife to repeat it, as it injured her health. My friend, Dr. E. S. Bates of this city, has a lady acquaintance who has, he says, the same power. Dr. Beard told me a year ago that similar experiments had been tried by some friends of his in Boston.

I believe that the above experiment was the first successful one in which this power of *clairvoyance* was so carefully tested in broad daylight, with every possible source of error excluded. We were none of us able to see how any trick could have been played; nor was there any object for trickery, as no money was paid, and the experiment was only allowed as a special favor.

I venture, therefore, to submit the account which is here written out in full for the first time. It is quite possible that this power of exaltation of vision may explain many cases of so-called 'transferred impression;' at any rate, experimenters like Messrs. Gurney and Myers should be aware of its probable existence. C. L. Dana, M.D.

THE WEATHER IN APRIL, 1883.

The most marked storm of the month appeared on the North Pacific coast on the 18th. Crossing the Rocky Mountains, it was central in Colorado on the 21st, and passed off the Atlantic coast on the 23d. On the 21st, pressures below twenty-nine inches (lower than before noted in this region in twelve years) were recorded in and near Colorado. Attending this depression were exceedingly severe local storms and tornadoes, which form the main feature of the weather this month. These were specially severe in Iowa, Alabama, Mississippi, and Georgia. In the latter two states, from two hundred to three hundred people lost their lives. In Colorado a passenger-train was thrown from the track near Como on the 21st; at Pueblo the storm began at 2 P.M. of the same date, and was the worst ever known there: several houses were unroofed. Kansas reports a tornado at Kingman on the night of the 20th: it struck Lun City at 2 A.M. of the 21st, destroying five houses, and killing two people; hailstones nine inches in circumference fell in Harper county; at New Bedford three houses were blown down, and one person was killed. Iowa was visited by tornadoes during the nights of the 21st and 22d: these destroyed farmhouses, and some lives were lost. Mississippi reports a tornado at 1.10 P.M. of the 22d, near Starkville: its width was three hundred yards, and within it every thing was levelled to the ground; one life was lost. The most terrible disaster from this cause occurred in Wesson and Beauregard, about a hundred and forty miles south-south-west of Starkville. Wesson, a town of seventeen hundred inhabitants, was struck at 3.15 P.M. of the 22d. Twenty-seven houses were destroyed, sixty people injured, and thirteen were killed. At Beauregard, with six hundred inhabitants, the tornado, lasting fifteen minutes, destroyed every dwelling and store, seriously injured forty, and killed twenty-nine people. Clay county was visited by two tornadoes,—one at noon, and the other at 1 P.M. of the 22d; both were violent, causing loss of life and property. In Monroe and neighboring counties to the north, a number of persons were killed. In Jefferson county the tornado is reported at 11 A.M. of the 22d: it was two hundred yards wide, and swept every thing before it. There was some loss of life. Ten people were killed at Harrisville, seven near Morton, and two at Caledonia. The storm passed east of Natchez at about 10.30 A.M., and east of Monticello (nearly destroyed by the tornado of April 21, 1882) at 11 A.M., 22d. The track was about two hundred yards wide. There was some loss of life. In Alabama, at Talledega, a train was blown from the track. In Georgia the storm, accompanied by hail, began at Americus between 3 and 4 P.M., 22d. As far as known, the track was narrow. Buildings were blown down, and some persons killed. The next morning, between 6 and 7, a tornado passed through Emanuel county, about a hundred and twenty miles east-north-east from Americus: all houses in its track were swept away, two persons killed, and several injured. A like storm-wind was felt in Dodge county about the same time. In Dougherty county the track was about a quarter of a mile wide. Eight persons were killed, and twenty injured. Loss of life and great damage



MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, APRIL, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF CHIEF SIGNAL-OFFICER.

to property are reported from Clark and Crawford counties. South Carolina reports a tornado at Bishopville about 8 A.M. of the 23d. The main track was about a hundred and fifty yards wide, and within it every thing was swept away. North Carolina reports a tornado at 7 A.M. of the 23d, with a path a hundred and fifty yards wide and about four miles long. In Tennessee, winds of great violence are reported at Chattanooga from 4.40 to 5.10 P.M. of the 22d. At Knoxville, 3.75 inches of rain fell on the 22d, which is the greatest fall in twenty-four hours for five years.

Accompanying is the iceberg chart for April. The icebergs appear to have been most numerous between latitude 41.5° and 43.5°, and longitude 51° and 49° W. This region is less extensive than in April, 1882; and, while solid field-ice was reported as far as latitude 44° last year, none was seen this. The map, p. 537, shows, that, as usual in this month, the winter area of high pressure in the Rocky Mountain region is giving way to the summer area of low pressure. The mean pressure is generally below the normal, except in New England, where it is .07 inch above.

The mean temperature east of the 100th meridian was 1.95° above the mean for the past ten Aprils, the Atlantic states and the lower lake region only, having temperature deficiencies.

Deficiencies in rainfall of .05 inch and over are found in New England, upper lakes, northern Rocky Mountain plateau, and the middle Pacific coast region. Above thirty inches of snow fell in Cisco and Summit, Cal., and on Mount Washington, New Hampshire.

A total air motion of 23,900 miles is reported from Mount Washington, with a maximum velocity of 88 miles per hour on the 11th. At Cape Mendocino, California, on the 15th, the wind rose to 120 miles per hour, when the anemometer cups were blown away. 124 cautionary signals were displayed, of which 91% were justified by winds 25 or more miles per hour.

Severe freshets occurred in Canada and New England from melting snows as much as from rains. The Mississippi was above danger-line at Cairo, Vicksburg, and New Orleans, but no serious damage had resulted. On the 21st, Helena, Ark., experienced the heaviest rain in many years. Nashville, Tenn., on the night of the 21st, had five inches of rain, which raised the river sixteen feet in twenty-four hours, causing damage to bridges and railroads.

Two prominent auroral displays may be noted. The less brilliant, on the 3d, was generally observed in Canada and New England; it was also noted in Washington Territory. On the 24th was observed the more brilliant and extensive one. This was seen at Nashville, Tenn., at 7.50 A.M., as an arc of whitish light extending to the height of 9° and over 40° of the northern horizon: it was seen as far west as Fort Benton, Montana. Less important displays were seen in the United States on nearly every night.

Prof. D. P. Todd of Amherst reports sun-spots most prominent on the 15th, and least so on the 30th.

At 8.50 A.M. of the 2d, two light earthquakes were felt in San Francisco, and at 2.36 A.M. of the 12th a heavy shock was felt at Cairo, Ill. *The New York herald* reports a severe shock in Catania, Sicily, on the 3d, and *Nature* reports a shock in Finland at 9 A.M of the 8th.

NEW LABORATORY FOR PHYSICS AND CHEMISTRY AT CORNELL UNIVERSITY.

THE new laboratory of physics and chemistry, of which the plans and perspective drawing are given, is now practically completed, and will be ready for occupancy at the beginning of the next autumn term. The general arrangement of the building will be readily under-

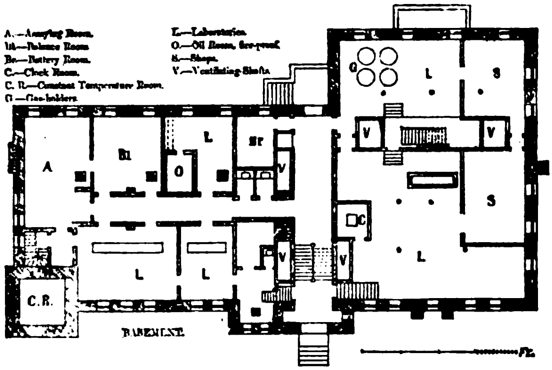
stood from the plans. The basement contains the laboratory of assaying, the large physical laboratory, and a number of rooms devoted to special purposes in the department of physics, three of which have floors of cement, affording at any point sufficiently firm foundation for galvanometers. Certain other rooms are provided with solid masonry piers for apparatus requiring immovable support

The large physical lecture-room, with its adjoining apparatus-rooms, occupies one-half of the first floor. The remainder consists of laboratories and work-rooms designed for various purposes of instruction in physics, several of which are also provided with masonry piers. One room (without windows) is for photometric work.

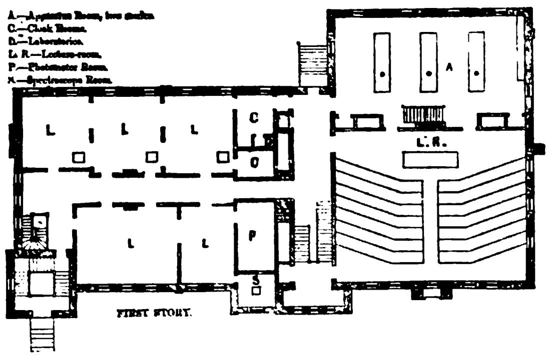
Power from a large turbine, situated in the gorge north of the building, serves for driving dynamos, ventilating machinery, and air-pumps for vacuum and blast, as well as for the purposes of the workshop. The latter is fully equipped with tools and machinery, and is in the charge of a skilful mechanic from Göttingen, who devotes his whole time to the manufacture of apparatus.

All the principal rooms of the building are supplied with water, steam, house-gas, oxygen, hydrogen, vacuum, and blast. The oxygen and hydrogen are generated by electricity from the dynamos, and stored in large gasometers, the apparatus employed producing hydrogen at the rate of three cubic feet per hour. In all the rooms where time observations are to

NEW LABORATORY FOR PHYSICS AND CHEMISTRY, CORNELL UNIVERSITY.



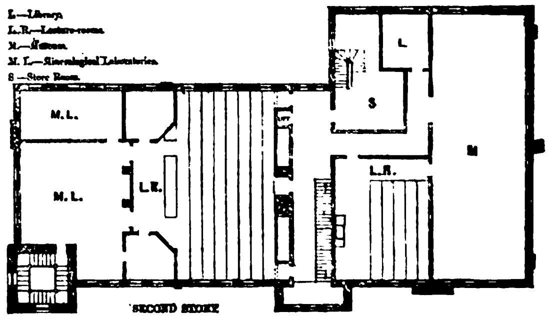
be made, there are clocks controlled, according to Jones's method, by a standard clock provided with Professor Young's gravity escapement. The room in which this beautiful instrument stands is, like the constant temperature room in the basement of the tower, provided with double walls to prevent fluctuations of temperature. Among the instruments of precision included in the equipment of the laboratory, may be mentioned two cathetometers, a standard metre and yard by Professor Rogers of Cambridge, one comparator, two fine chronographs, three sphe-



rometers, a spectrometer with twelve-inch circle reading to single seconds, two magnetometers, several galvanometers of high and low resistance, sets of resistance coils, and different forms of calorimetric apparatus.

Students entering the laboratory begin with simple illustrative experiments, and, as they acquire skill in manipulation, are assigned experiments requiring the use of instruments of precision. Some of the more advanced are now making determinations involving measurements of the greatest accuracy.

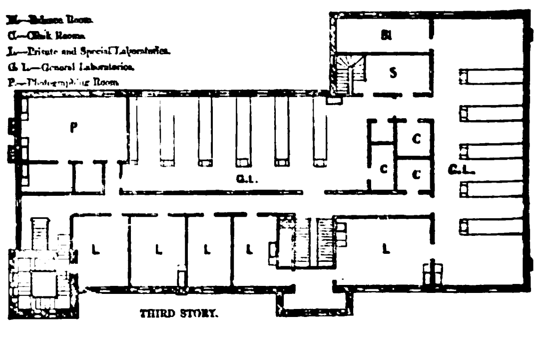
On the second floor are the mineralogical laboratory, furnished with blowpipe tables covered with white Minton tiles, the large chemical lecture-room, the museum for the collections of mineralogy and industrial chemistry, storerooms, and private laboratories. The third floor consists of, the laboratories for qualitative and quantitative analysis, the photographic laboratory, rooms for special work in organic chemistry and gas analysis, balance-room, reading-room, and storerooms.



The equipment of the building will be complete in every particular; and no pains have been spared to secure the most perfect apparatus to be obtained at home or abroad. Many important improvements in the fixtures and arrangement of the laboratories, work-tables, gas and water supply, have been introduced.

The two departments have been rapidly outgrowing their accommodations during the past few years, and the increased laboratory space the new building will afford will effect a marked increase in the amount of special and original work.

SPENCER B. NEWBURY.



ST. DAVID'S ROCKS AND UNIVERSAL LAW.

A DISCUSSION of the St. David's rocks has been opened in the Geological society of London by Prof. A. Geikie, director of the Geological survey of Great Britain and Ireland, which possesses great interest to all persons engaged in the study of the older crystalline rocks. The St. David's rocks, according to Dr. Hicks, consist of three distinct pre-Cambrian formations in ascending order: the Dimetian, composed of crystalline, gneissic, and granitoid rocks; the supposed unconformable Arvonian, formed of felsites, quartz porphyries, hälleflintas, etc.; and the Pebidian, supposed to be unconformable to both the preceding, and made up of tufas, volcanic breccias, and basic lavas. The Cambrian is said to overlie all these, and to have a basement conglomerate composed of their ruins.

Dr. Geikie maintains that the Dimetian is an eruptive granite, which has disrupted and altered the Cambrian strata, even above the horizon of the supposed basal conglomerate. Besides a pebbly quartzite formed of fragments torn from the Cambrian conglomerate and greatly indurated, no rock, except diabase, is found, according to him, in the granite area; and this occurs throughout the entire district. The granite cuts through successive horizons of the Cambrian strata, and is younger than all of that formation in the district. The Arvonian consists of quartziferous porphyries, or elvans (associated with the granite), and of the metamorphosed strata adjacent. The Pebidian consists of a series of volcanic tufas and breccias, with interstratified and intrusive lavas.

Geikie holds that the Pebidian is an integral part of the Cambrian. It is cut by the Arvonian porphyry and Dimetian granite, and is therefore older than these. It is covered quite conformably by the Cambrian conglomerate, and not unconformably, as Hicks claimed. Seams of tufa are interstratified at various horizons in the conglomerate and strata above. This Cambrian conglomerate, instead of being composed of fragments of the Dimetian, Arvonian, and Pebidian, consists almost entirely of quartz and quartzite; "only four per cent of fragments having been found to have been derived from some of the projecting lava-islands underneath it." Professor Geikie then claims that the names Dimetian, Arvonian, and Pebidian "had been founded on an error of observation, and they ought to be dropped out of geological literature."

Prof. A. Renard also states that he had examined these rocks microscopically, in concert with Drs. Zirkel of Leipzig, and Wichmann of Utrecht; and their conclusions are, that the so-called Dimetian rock is unquestionably a true granite (eruptive). The quartz porphyries were like the contact specimens of granite, and believed to be such. The tufa found in and above the conglomerate is a true tufa, and not a mere superficial waste of older volcanic rocks. The observed foliation existed above the conglomerate as well as below.

That the questions involved in Dr. Geikie's position are deeply interesting, is manifest from the fact that some fourteen persons joined in the discussions which followed its statement. These questions are of equal interest to American geologists and petrographers, since they are the same as those the present writer has raised regarding eastern Massachusetts, — a district similar to St. David's, — also similar to those raised by Professor Dana against the Taconian, Montalban, and Huronian, in New England; by Dr. Selwyn, concerning the Norian, Montalban, and Taconian, in Canada; by Messrs. Whitney, Selwyn, Winchell, and Wadsworth, with respect to the Lake Superior geology; and by Geikie and Wadsworth, regarding the Fortieth parallel exploration.

The writer has nowhere seen any general statement of the bearings of these questions; and it may be briefly indicated here what some of them seem to him to be. They seem to be involved in the distinction between one universal law, moving in a uniform, definite direction, and recurrent phenomena or special creations and conditions. Under the latter view there seems to belong the belief that detrital or chemical sediments are returned to eruptive forms; that eruptive rocks are of chemical or sedimentary origin; that these were different in pre-tertiary time from what they were in the tertiary; that certain geological periods are marked by certain kinds of rock; that the azoic system has been subdivided upon natural principles; that there have been recurrent periods of heat and cold. This view includes the theory of the metamorphic origin of granite, the present geologico-mineralogical classification of rocks, and embraces uniformitarianism, catastrophism, plutonism, and neptunism.

The other maintains the existence of a universal law, which should be the guide in all investigations, — a law, which, in its more special applications, Professor Whitney has endeavored to illustrate in his Climatic changes, and Sir William Thomson in his papers on the age of the earth and sun, — a law which the present writer has tried to express in his petrographical work. It is regarded as the law which will one day be completely worked out, and in accordance with which our views in history, philosophy, science, — all branches of human knowledge, — will then be reconstructed. The expression of the law varies in different ages, but for the physical universe it seems best formulated at the present time by Sir William Thomson: The degradation and dissipation of energy, the passage from the unstable towards a more stable condition, the tendency to harmonize with the environment, — the law under which the universe has moved from the beginning, and under which it will continue its course uniformly towards the end; it assumes that no turning-back can occur, and that no energy once lost can be restored, except by the same Almighty Power which gave it birth.

M. E. WADSWORTH.

THE HUMAN REMAINS OF THE BONE-CAVERNS OF BRAZIL.

THE discovery by the late Dr. Lund of human remains associated with the extinct mammalian fauna of the caverns of Lagoa Santa in the province of Minas Geraes, Brazil, made famous by his researches, has, until recently, passed almost unnoticed among ethnologists. Dr. Lund's statements in the communications which accompanied the human bones, sent to the societies of Rio de Janeiro and Copenhagen, are, I believe (I write without the documents for reference), unqualified as to the direct association of the human with the extinct mammalian remains, and have been received as conclusive by prominent ethnologists. There can be no question of Dr. Lund's perfect good faith in the matter; but it may be asked whether, forty years ago, such care as is now considered necessary in such investigations would have been exercised, even by so able and conscientious an observer as Lund is recognized to have been.

So long a time has elapsed, that it is now difficult to verify the exact conditions under which the bones

were found. In a recent flying trip through the Lagoa Santa region, I made inquiries in regard to the matter, but failed to obtain any very definite information. According to the reports of the common people, many caverns were explored by Lund and his assistants in person for the express purpose of collecting fossils, while others were worked by the people of the vicinity for saltpetre, who, under instructions from Lund, and probably as far as possible under his supervision, saved the fossils disinterred in their operations. I could learn nothing as to the conditions under which the human skull now in the museum at Rio de Janeiro, and stated to have been found with remains of extinct mammals, was met with. More definite, and apparently reliable information was given in regard to a complete human skeleton which was one of a lot sent to Copenhagen. A workman in one of the saltpetre caves at some distance from Lagoa Santa found the skeleton in his work, and, to gain the reward offered, took it to Lund, who gave him the sum of forty milreis (about twenty dollars). This man is still alive; but, from lack of time, I was unable to see him. It is said, that, on his recent visit to Minas, the emperor had an interview with him on the subject.

Recently, while in New York, I had the good fortune to meet Mr. Nicholas Brandt, son of the late Prof. P. A. Brandt, who was for many years the secretary and companion of Dr. Lund. Mr. Brandt, who had spent some time at Lagoa Santa in company with his father and Dr. Lund, kindly gave me the following note: "The remains of the prehistoric man, discovered by Dr. Lund in Minas before I came to Brazil, and about which the professor sent his memoirs to the *Instituto historico e geographico* of Rio de Janeiro in January, 1842, and April, 1844, were often the subjects of our conversation. The doctor's opinion was positive that the skeletons belonged to the same period as the fossil fauna with which he enriched the knowledge of natural history to such a large extent. The opinion of Cuvier and Humboldt, Dr. Lund's friends, was fully justified in urging the doctor to go to Brazil, and use his energies in the service of this branch of science. The doctor was, of course, a pure follower of his friend Cuvier. Darwin and Darwinism were at that time hardly heard of, as his *Blik paa Braseliens Dyreverden* fully shows." Mr. Brandt adds, that but for the loss of all his private papers, including his Brazilian journal, and many letters from his father and Dr. Lund, in the Atlantic disaster some years ago, he would have been able to give a much more definite and detailed account of Lund's life and work at Lagoa Santa.

ORVILLE A. DERBY.

LETTERS TO THE EDITOR.

Solar constant.

THIS term is becoming prominent, and its use has given rise to some confusion. I find some authorities, taking the value given by Forbes, give 28.2 calories, while others give 2.82 calories. Since a calorie is the definite amount of heat required to raise a kilogram of water 1° C., it is evident that one of these is in error.

Professor Young, in his 'Sun.' p. 263, defines the solar constant as the amount of heat received per minute by one square metre exposed perpendicularly to the sun's rays at the upper surface of the atmosphere. No mention is made of the substance receiving the heat. In correspondence with Professor Young, I have received the following equation: the solar constant $= \frac{w}{s} \times \frac{t}{m}$, in which w = mass of water, s = surface, t = quantity of heat, m = unit of time. On this basis we may define the solar constant as the amount of heat received in a unit of time, by a unit of mass, spread upon a unit of surface, exposed as above. In this equation, however, we may divide w by s, and obtain d = depth, and we shall have the solar constant $= \frac{d \times t}{m}$; i.e., the solar constant equals the quantity of heat received from the sun at the limit of the earth's atmosphere, by a unit of depth of water, in a unit of time.

We may express this numerically as follows: take a square metre and spread upon it a kilogram of water; it will lie 1 mm. deep. Since the kilogram is the unit used in defining the calorie, we may say, using Forbes's value, that the solar constant, 28.2 calories, is the amount of heat received by 1 mm. depth of water exposed as above. The use of the term 'calorie' seems unfortunate; and we might adopt, as more satisfactory, a centimetre as the unit of depth, and degrees as expressing heat. We would then have the solar constant equal to 2.82 Centigrade-centimetre-minute degrees, or 2.82 ccm°.; i.e., the sun's heat falling upon a centimetre depth of water would raise it 2.82° C. in one minute.

This will be recognized as of the same form of expression as adopted by Herschel, who describes the sun's heat as sufficient to melt a coating of ice an inch thick in 2 h. 13 m. nearly.

H. A. HAZEN.

Spanish folk-lore.

In the account of folk-lore in Europe, in SCIENCE for May 25, I see no notice of Spanish efforts in that field. My acquaintance with the subject is but slight, yet it has extended to the important and interesting works of Antonio de Trueba, who, in 1873, spoke of himself as "almost the only writer of our country who has given himself with any diligence to this task (the collection of popular stories), especially now that the illustrious Fernan Caballero rests from his most glorious labors." The method of Trueba differs from that of the brothers Grimm, for example, in that he adds the polish of his admirable style to the rough form of the stories as they fall from the mouth of the people; such a process being necessary, he maintains, in order to fit them for a place among the products of the literary art. I subjoin a list of his publications in this department: *Cuentos de color de rosa, Cuentos campesinos, Cuentos populares, Cuentos de vivos y muertos, Cuentos de varios colores,* and *Narraciones populares.*

ROLLO OGDEN.

Cleveland, O., May 28.

Capture of the crested seal on the coast of Massachusetts.

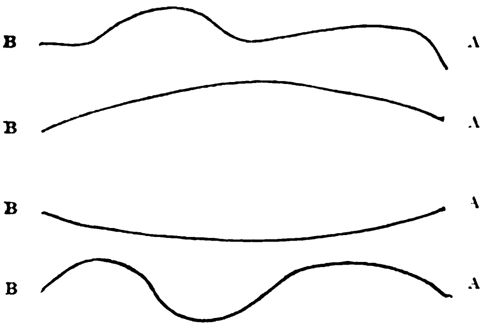
At various times large seals have been seen or taken on the coast of Massachusetts, and, although in no case positively identified, presumed to be examples of the crested seal (Cystophora cristata), mainly because a specimen of this species, described long since by Dr. DeKay, was taken in 1824 in a small creek emptying into Long Island Sound at East Chester, about fifteen miles from New-York City. As two other large seals — the gray seal (Halichoerus grypus) and the bearded seal (Erignathus barbatus) — are almost as likely to occur on the New-England coast as this one, it is some satisfaction to be able to record the capture of a well-identified example of the crested seal in Newburyport harbor, May 2, 1882. Mr. E. C. Greenwood of Ipswich, by whom the specimen was secured and mounted, informs me that

it was a fine adult male, eight feet in length, weighing very nearly one thousand pounds. The specimen was purchased by Dr. G. E. Manigault for the museum at Charleston, S.C., where it is now preserved.

That this species is prone to wander far from its usual haunts — the icefields eastward of Newfoundland and northward — is attested by its capture, not only near New-York City, but also at Cambridge, Md., in an arm of Chesapeake Bay, as recorded some twenty years ago by Professor Cope. The present record, however, is the first of the capture of a positively identified example of any seal on the New-England coast other than the common small harbor seal (Phoca vitulina). J. A. ALLEN.

Flight of the flying-fish.

On a recent trip from New York to Galveston, with the weather at the start cold and chilly, wind north-east, and ending in the Gulf with clear sunny days and summer breezes, there was every opportunity afforded for watching the flight of flying-fish. The first fish were seen two days out of New York; and on every day thereafter, save on one when off the coast of Florida, numerous brown pelicans were observed. Probably the flying-fish found the atmosphere a trifle heavy, flitting about with pelicans for interested spectators, and attended strictly to their domestic duties. The act of flying is somewhat startling, the fish emerging with much energy, and, from the very start, buzzing its wings like a humming-bird; and in no instance did the buzzing cease until the fish disappeared in the sea at the end of its flight. The longest flight observed continued, without any contact with the water, for nine seconds; estimated distance, six hundred to eight hundred feet. In some cases the flight was nearly horizontal; in most cases, however, it was arched vertically. Flying across the wind, it was noticed that contact with the water did not apparently retard the movement of the fish in the air. Some of them made four contacts before finishing the flight. The wind had some effect upon the direction and character of the flying; but fish were noticed going with the wind, and crossing it in every direction, and a few flying directly



against it; A being the starting-points; B, the end, and the line of flight being shown as it appeared from a point in a vertical plane connecting A and B.
GEORGE J. CARNEY.

Lowell, Mass.

Sun's radiation and geologic climate.

It seems to me that Mr. Warring, in his objection (SCIENCE, p. 395) to the assumption that the dissipation of solar energy from loss of heat diminishes the supply of sun-heat received by the earth, has overlooked the very important factor of the variable area of the contracting sun. To make this clear, let

Q = Quantity of heat incident normally on a unit surface in a unit of time, at the earth's distance from the sun.

R = Radiating or heat-emitting power of each physical point of the sun.

A = Area of projected surface emitting heat normally = Area of great circle of sun regarded as a sphere.

Then evidently, at a given distance, we have, Q varies as $R \times A$: hence, taking the example cited from Newcomb (as A varies directly as the square of the sun's diameter), if the temperature of the condensed gaseous mass is doubled by contraction to one-half its primitive diameter, its area (or A) would be reduced to one-fourth its original area; so that, notwithstanding the assumed augmentation of temperature of the sun, the supply of heat received by the earth (or $R \times A$) would not be increased, unless R augmented in a ratio greater than the square of the temperature. It is difficult to assign precisely what function R is of the temperature of the radiating body: some physicists (Rossetti) make it proportional to the square of the absolute temperature; while others (Stephan) make it as high as the fourth power of the absolute temperature.
JOHN LECONTE.

Sphere anemometer.

I am rather amused to see in SCIENCE, p. 228, that Dr. Sprung of Hamburg has re-invented an anemometer well known (but not used) in this country; viz., Howlett's. Dr. Sprung, and all who wish to help forwards our knowledge of wind-force, should begin by making themselves acquainted with what has already been done. In the *Quarterly journal of the meteorological society*, viii., p. 161, will be found an Historical sketch of anemometry and anemometers, by J. K. Laughton, M.A., F.R.G.S., president meteorological society, and in it will be found notices of about two hundred patterns. The full description of Howlett's is given in the *Proceedings British meteorological society*, iv., p. 161; but even Howlett was not the first to use the sphere; for in Mr. Laughton's address he remarks, "The sphere as a pressure-plate at the end of a swinging rod had been suggested, and possibly used, many years before Mr. Howlett's time, as a rude anemoscope. It is mentioned vaguely by Hülse (*Allgemeine maschinen encyclopädie*, under anemometer) in 1841, and is said by Mr. Bender (*Proc. inst. civil engineers*, March 14, 1882) to have been used by Parrot; but this I have not been able to verify." G. J. SYMONS, F.R.S.

62 Camden Square, London N.W.,
May 19, 1883.

SCIENCE AND RELIGION.

Studies in science and religion. By G. FREDERICK WRIGHT. Andover, *Draper*, 1882. 16+390 p. 16°.

WE hail the appearance of a book on this subject by one who is an earnest worker in both theology and science as a sign that the unnatural conflict between these two great departments of thought will speedily abate, and their differences be adjusted on a rational basis. The conflict is, in our opinion, the

result of narrowness and dogmatism on both sides, and will never end, until, on the one hand, theologians not only acquaint themselves with the *facts*, but deeply sympathize with the *spirit* of science, and, on the other, scientific men not merely retain in memory from childish days some extreme forms of religious dogmas, but enter deeply and lovingly into the profound truths which lie at the root of these dogmas. The author certainly deserves the thanks of all fair-minded men for the judicial spirit in which he treats the points in dispute.

As indicated by the title, the book is not a systematic treatise, but rather a collection of essays written at different times, but following a continuous line of thought. Chapter i., as introductory to all the rest, treats of the ground of validity of induction. In this the author shows that both scientific and religious beliefs rest on induction. In both we attain, not demonstrative certainty, but probabilities of all degrees. In both we demand only the best working hypothesis. Having thus in his first chapter laid a foundation, in his second and third he takes Darwinism as an example of scientific induction, and gives a discussion which is so fair that Darwin himself, we are sure, would be satisfied. In the fourth chapter he discusses the question of evidence of design in nature, and shows that Darwinism is not, as some suppose, destructive of the doctrine of design and final causes, but only elevates and ennobles our conceptions of the designer, or, to use his own words, that "there is a divinity that shapes the ends of organic life, let natural selection rough-hew them how it will."

The impression received from reading these chapters is that the author, while not championing the cause of Darwinism, believes that some form of evolution — i.e., the origin of species by derivation with modification — is extremely probable. Yet he clearly sees (as every one ought to see) that the origin of species by derivation need trouble the theologian no more than the origin of any thing else by secondary processes.

In the fifth chapter the author runs a remarkable parallel between Darwinism and Calvinism, showing how both insist on absolute continuity and reign of law, how in both individual ends are sacrificed to general ends, and how both, if carried to extreme, tend to fatalism. In both, also, we are brought face to face with the same irreconcilable antithesis; for, if one strives in vain to reconcile the freedom of man with the absoluteness of God, the other must strive in vain to show how the free will of man is consistent with the invariableness of law. Our own view on this subject is briefly this: there are two modes of viewing nature, which may be called the religious and the scientific. According to the one, God in nature operates nature, but according to regular laws, which we call the laws of nature; according to the other, nature, for all practical purposes, may be regarded as operating itself. Both of these views are, we believe, legitimate. When we deal with nature, we practically must hold the latter; when we retire to the inner sanctuary of philosophic thought or religious emotion, we must hold the former. The one is the necessary work-clothes of our *outdoor life*, which we must put off when we return home to enjoy our *inner life*. For finite man this apparent inconsistency — this daily change of clothing — is the truest wisdom. But those who *will* be logically consistent in detail, even at the expense of one-half of all philosophy, run, on the one hand, into *extreme Calvinism*, or, on the other, into *universal automatism*, — the one a spiritualistic, the other a materialistic fatalism.

Chapter vi. is a really admirable *résumé* of the question of prehistoric man, — his relation to the glacial epoch, and his probable antiquity. This being the field of his own scientific work, the author is here at home; and geologists will read this chapter with especial interest as an authoritative statement of the latest and best views on the subject of the glacial epoch in America, and especially of the course and character of the ice-sheet moraine. In fact, it is to our author, in connection with Professors Chamberlin, Upham, and Lewis, that we are chiefly indebted for tracing the ice-sheet moraine through the United States, and thus generally settling the fact of the former existence of such an ice-sheet.

As to the antiquity of man: while his existence during the latter portion of the quaternary, and his coexistence with a now extinct mammalian fauna, is admitted, yet reasons are given for the belief that the time elapsed since the glacial epoch is much less than usually supposed by geologists. The author thinks that the flooded rivers and lakes which characterized the close of the glacial epoch, and which were undoubtedly seen by man, may not have been more than ten thousand years ago. For our own part, while we believe that some years ago there was too strong a tendency, on the part of many geologists of the uniformitarian school, to stretch the time beyond reasonable limits, yet recently in this country the ten-

dency has been, perhaps, too much the other way. Ten thousand years seems a short time for the completion of such great changes as we find in river-beds, in lake-margins, and in mammalian species.

In the last chapter the author discusses the relation of the Bible to science. Perhaps the time is not yet fully ripe for final adjustment here. But one thing is meanwhile certain: all the harm which has come, or will ever come, of the discussion of this subject, comes only of a narrow, intolerant spirit on both sides. Nothing but good can come of the freest inquiry, if only it is conducted in a simple, reverent, truth-loving spirit.

But as many will think that a reviewer is 'nothing unless critical,' we must find some faults, even if they be but errors of typography, or slips of the pen. Of the former, we find one on p. 329, where 70° instead of 20° from pole is given as the position of the antarctic continental ice-foot. Among the latter, we notice on p. 310 that the bluff-deposit of the Mississippi River is spoken of as the '*orange sand.*' The bluff-deposit is a very fine silt (loess) overlying the coarse orange sand. Again: the transition from paleozoic to mesozoic can hardly be called 'one from water-breathing to air-breathing animals,' since air-breathing insects lived in the Devonian, and air-breathing insects and amphibians were abundant in the carboniferous.

Finally, we should state that the book is illustrated by several plates, which greatly increase its value.

THE TOPOGRAPHICAL MAP OF NEW JERSEY.

A topographical map of a part of northern New Jersey, from surveys and levellings made, and local surveys corrected. By GEORGE W. HOWELL, C.E., and C. C. VERMEULE, C.E. *Julius Bien, lith.*, 1882. 87.5×88 cm.

ALL of our state geological surveys have been hampered by a lack of topographic maps on which to record and publish their results. The geological maps thus far completed have in nearly all cases been based on compilations of county and other surveys, executed at different times, on different plans, and seldom with sufficient geodetic triangulation to insure accuracy. Representation of mountain form is in nearly all cases excessively incorrect. When careful topographic surveys have been made, they have unfortunately too often followed instead of preceded the geological examination. As it is now too late to go back and perform the work in proper order, the next best plan is at least to carry on topographic surveys wherever possible, and secure, as soon as may be, the good results of a close knowledge of the form of the various states. Such work is going on in New York, and a careful triangulation has been carried across the state; but, with the appropriation at present grudgingly afforded this work, many years must pass before it is completed. New Hampshire has taken advantage of a triangulation executed for it by the U. S. coast-survey, and constructed a large six-sheet map on a scale of two and one-half miles to the inch (1:158,400), with contour lines every hundred, and in parts every fifty, feet; but these latter are by no means of final accuracy. This map was issued with geological coloring in 1878; and that part including the White Mountains has been published apart in *Appalachia*, vol. i., uncolored, and also by the surveyor, Mr. H. F. Walling, with hypsometric coloring. Another notable contour-line map is that of 'Morrison's Cove,' surveyed by Mr. R. H. Sanders, to illustrate Mr. Fr. Platt's report on Blair and Huntingdon Counties, Penn. (*Second geol. surv. Penn.*, *T.*, 1881). It is printed in fourteen large sheets, on a scale of sixteen hundred feet to an inch (1:19,200), or about three and one-half inches to a mile, with contours every twenty feet, and is colored geologically. Being in a region of typical Appalachian form, it has an especial value in showing this remarkably interesting style of mountain surface. A photographic plate from a model constructed from this map by Mr. E. H. Harden has been published (*Proc. Amer. phil. soc.*, xix. 1881), and gives a finer view of the intricacies of Pennsylvanian topography than any thing else that has yet appeared. It is to be hoped that the other models constructed for the Pennsylvania survey may be treated in the same way. A second example of fine topographic work on the same large scale is in the lately issued map of the Panther Creek basin by Mr. R. P. Rothwell (see SCIENCE, p. 310), which makes the first of a series of maps that will illustrate the survey of the anthracite district of Pennsylvania, in charge of Mr. Ashburner. The large number of accurate surveys of private property in this region, and the numerous railroads crossing it, will furnish a valuable basis for the final work of the state geologists, and its interesting form and unique structure will at last find adequate representation.

The topographic map now in course of construction and publication by the Geological survey of New Jersey, under the direction

of Prof. G. H. Cook, bids fair to outrank those already mentioned, as it alone combines all the elements for successful completion. It has the advantage of thorough triangulation, including twenty-six primary stations furnished by the U. S. coast-survey, — a work still in progress, but approaching an end. This is illustrated by a very delicately prepared map in Professor Cook's annual report for 1882. The process of local triangulation and levelling was begun in the northern part of the state, and field-observation is already done for most of the area lying north of a line from Belvidere to Sandy Hook. The area of which the sheets have been published contains 847 □ miles of New-Jersey land, and laps eastward on New York. Its centre is near Orange, and it includes Paterson and Perth Amboy north and south, and Brooklyn and Boonton east and west. The scale is one mile to an inch (1 : 63,360), sufficiently detailed to show all the artificial topography even in the city portions of the map, and to include many of those mythical rectangular streets laid out on town plans, and 'accepted' by the local authorities, although often entirely regardless of the lay of the land. The contours are drawn in faint red lines, showing differences of level of ten feet in plain country, and twenty feet in the hilly portions. Water-surfaces are colored blue, and depth-lines are drawn at intervals of ten feet. The chief topographic features thus shown are the strong, regular lines of the triassic trap-ridges, — the Palisades and the double Wachung Mountains, — with their bold eastern face and long slope, on the west; the more irregular highland country of the azoic rocks, on the north-west; the great area of salt-marsh lands, built up to tide level along the Hackensack River and Newark Bay; the extensive fresh marshes and flats on the upper course of the Passaic, within the curve of the Wachung range, — the remains of an old lake held by drift-barriers, as explained in the report for 1880; and, finally, the line of the terminal moraine, especially as it crosses the flat sandstone country from Metuchen northward to Locust Grove, where it climbs the trap-range. Even in this short distance, over forty of its characteristic little ponds, that would be quite unnoted on ordinary maps, are shown upon its rolling back. The completion of this map for the entire state will be an immense gain for its people.

The distinctly practical ends that mark the work of the New-Jersey survey justify the subordination of natural to artificial topography; the former being mostly indicated in the fainter red, and the latter in the stronger black lines. It would be, however, of much practical as well as scientific interest to try a reversal of these colors on a special edition of the map, in order to show more distinctly the natural features of the state, and give a properly secondary place to the towns, railroads, and lettering. As now printed, the ridges of the Wachung Mountains are rivalled by the Central railroad with the parallel roads beside it; and the mountain form is obscured, except to a very close search, among the streets of Orange and Paterson. And, as where so much good work has been accomplished we naturally look for more, it seems not too much to hope that future years may see the entire map appear with geological colors, in which the detrital surface-deposits are shown, as well as the consolidated underlying formations, the latter being indicated only where they outcrop, or are covered by an insignificant soil.

CRUSTACEA OF THE BLAKE AND TRAVAILLEUR EXPEDITIONS.

Recueil de figures de crustacés nouveaux ou peu connus. Par M. A. MILNE-EDWARDS. 1ère livraison. [Paris], April, 1883. 3 p + 44 pl. 4°.

THE coast-survey dredgings, under the direction of Pourtalès, in the Straits of Florida, first revealed the wonderful richness of the crustacean fauna beyond the shallow waters of our southern coast. The earlier collections of Pourtalès were unfortunately lost in the great Chicago fire; but Stimpson's preliminary report on the Brachyura, published in 1870, gives some indication of their extent. The subsequent explorations, under the direction of Pourtalès, the elder Agassiz, and Stimpson, more than replaced the collections destroyed at Chicago; while the work of the Blake, under the direction of Alexander Agassiz, in 1877, 1878, 1879, has far excelled all earlier explorations in bringing to light great numbers of new and remarkable forms. All the crustacea from these later explorations have been submitted to Alphonse Milne-Edwards of Paris, who has from time to time described and figured a considerable number of the Brachyura in his great work on the crustacea of Central America and the Mexican region. The progress of this work has been exceedingly slow, however, the Carcinoplacidae not yet being reached; so that the groups containing the most remarkable forms were left untouched until the appearance of the preliminary report on the Blake crustacea in the bulletin of the Museum of comparative zoölogy. This short report, though extending only to the higher Macrura,

enumerates over two hundred species, and characterizes as new to science twenty-eight of the genera and more than a hundred of the species. As a continuation of this report, preliminary notices of more of the Macrura appeared in the *Annales des sciences naturelles* for 1881. The explorations of the Travailleur on the other side of the Atlantic in 1880, 1881, 1882, have also brought to light numerous new forms, which have been briefly described or mentioned by Milne-Edwards in several reports upon the work of the Travailleur. These preliminary reports of Milne-Edwards, though they revealed astonishing discoveries, gave very little idea of the strange new forms discovered; and the accumulation of such a mass of imperfectly described genera and species was fast becoming a serious obstruction to the work of others in the same department. The work which is the subject of this notice begins to obviate this difficulty by the issuing of advance figures of the new forms referred to.

This first fasciculus of the work consists of a titlepage and a two-page list of plates printed by some autographic process, and forty-four plates, of which thirteen are engraved, and the rest printed like the titlepage and list of plates. The engraved plates are all proofs before letter, and represent species from the Travailleur expedition only, while the autographic plates represent species from both Travailleur and Blake expeditions, and a few from other sources. None of the plates are numbered in any way, — an unfortunate omission, which renders references to them difficult; but the names of the species are printed on them, and on the autographic plates the station and depth are usually added. The whole number of species figured is sixty-one; of which thirty-one are from the Travailleur, twenty-six from the Blake, three from the U. S. fish-commission, and one from the Godeffroy museum. The autographic plates, though rough in appearance, are apparently quite as accurate as the highly finished engravings, and have the great advantage of showing the work of the draughtsman only.

The most remarkable forms figured are from the Blake collection. Phoberus caecus, one of these, a Macruran as large as the lobster, resembles Palaemon in external form, but has rudimentary eyes not projecting beyond the carapax, and is said to have branchiae like the Astacidae. Xylopagurus rectus is a hermit-crab, which inhabits tubular stems of plants open at both ends, has a bilaterally symmetrical abdomen with the penultimate somite developed into a calcarous operculum, which closes the posterior opening of the tube. Pylocheles Agassizii, another hermit-crab, lives in cavities in hard fragments of agglutinated sand, and has a well-developed, symmetrical abdomen like the typical Macrura. One of the most interesting types is Glyphocrangon, represented by three species, the figures of which well illustrate the utility of figures and the slight value of Milne-Edwards's preliminary descriptions. The figures show Glyphocrangon to be the same as my Rhachocaris, figured and described in a report on the Blake crustacea of 1880 (*Bull. mus. comp. zoöl.*, x.). The genus was described by Milne-Edwards as having the telson completely consolidated with the preceding somite; which is not the case, the telson having a movable, though peculiarly constructed articulation, which is like the articulations between the three preceding somites of the abdomen. The structure of these articulations, which seem to have been wholly overlooked by Milne-Edwards, is so remarkable that I quote the following from my original description: —

> "In addition to the ordinary hinge at each of the articulations, there is a process arising from the anterior somite just below the hinge, and curved backward and upward concentrically with the hinge; and this process fits accurately, and is slightly overlapped along its edges by a similarly curved groove in the posterior somite. When the abdomen is completely flexed, the ends of these curved processes project dorsally considerably beyond the grooves; but, when the abdomen is fully extended, the processes are withdrawn so as to expose the dorsal part of the groove; and in this position, in the contracted alcoholic specimens, the somites are firmly clamped, apparently by the pressure of the ends of the processes upon the concave posterior walls of the grooves, and held rigidly extended, so that it is very difficult to flex the somites, unless the tip of the abdomen is pulled backward with considerable force, when the processes slide easily through the grooves, and the somites are readily flexed. It is probable that in life, while the extensor muscles of the abdomen are relaxed, the processes move easily through the grooves; but, when the extensor muscles are strongly contracted, the hinges are clamped, as in the alcoholic specimens, so that the animal can voluntarily hold the telson and the spiny terminal somites of the abdomen rigidly extended as a means of self-defence."

Another remarkable peculiarity of the genus, not noticed by Milne-Edwards, is the articulation of the coxae of the external maxillipeds with the edges of the carapax. Pontophilus Jacqueti, from the Travailleur expedition, is evidently not a Pontophilus, but a Ceraphilus, and is apparently identical with my C. Agassizii from this side of the Atlantic.

Nearly half of the species figured apparently belong in or near Pandalinae and Ephyrinae, which seem to be the most abundant of the deep-water Macrura. S. I. Smith.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Siemens on solar physics. — In a recent lecture at the Royal institution, Sir. W. Siemens discusses the subject of solar radiation. He gives reasons for fixing the temperature of the photosphere at about 2800° C., based, first, upon the behavior of a rod of carbon and a gas-flame in the focus of a reflector exposed to the sun; second, upon a comparison between spectra of different luminous intensities; and, third, upon experiments for determining the relation between temperature and radiation made by means of an iridio-platinum wire a metre long, heated by an electric current. He finds the radiation to be expressible by the formula, Radiation $= Mt^2 + \phi t$, M being a coefficient due to the radiating substance. He discusses also the effect of diminished pressure in lowering the dissociation temperature of compound gases, and restates and advocates anew his last year's theory of the maintenance of the solar heat. — (*Nature*, May 3.) C. A. Y. [1061

Scintillation of stars as affected by the aurora borealis. — M. Ch. Montigny, observing for many years at Brussels, has noticed, as previous observers have done, that the scintillation of stars is much increased during the occurrence of an aurora. He has noticed, further, that every aurora 'produces immediately its effects upon the scintillation,' that stars in the north are most affected, and that the influence of the phenomenon is most marked for the stars which are observed across the upper regions of the air. Magnetic disturbances also, even when accompanied by no aurora visible at Brussels, increase the scintillation to a marked extent. On two occasions during July, 1881, the effect of magnetic disturbances was observed with no aurora visible in Brussels, or even, so far as can be learned, in any part of Denmark. — (*Comptes rendus*, Feb. 26.) E. H. H. [1062

Deviation of axis of meridian-circle. — M. Loewy of the Paris observatory gives two new methods of determining the azimuth constant of a meridian-circle. The first method depends on the following principle: if we take two points in the path of a star so that the chord joining them is approximately at right angles to the instrumental plane, and not greatly different in length from the polar distance, the inclination of the instrumental axis to the equator can be determined by readings of the instrumental declination and distances from the instrumental plane. Owing to the limited field, only those stars whose polar distances are about 1° 40′ or less can be used. About one hour and forty-six minutes before meridian-transit, simultaneous readings of the right ascension and declination micrometers are made, and also a reading of the circle. It is not necessary to record the time. After an interval of about three hours and a half, the series is repeated. The chord of the path described by the star during this interval will equal its polar distance. From these observations, we can deduce the inclination of the instrumental axis to the equator, and by means of this the azimuth constant, without using the right ascension of the star. The method gives thus an independent determination of the azimuth. The old method, that of upper and lower culminations of the same star, requires an interval of twelve hours, thus greatly increasing the uncertainty of the determination on account of instrumental changes; besides, for a large part of the year it can be applied to only one star, α Ursae Minoris

M. Loewy's second method, which he does not consider as good as the first, depends on observations of the distance of the star from the instrumental plane, time of observation being accurately noted. When both right ascension and inclination of axis are sought, it is best to observe these polars at an hour angle of about three hours. When the interval between observations is twelve hours, the inclination of the axis can be determined independent of the right ascension.

M. Loewy gives some results of determinations of inclination by his first method which show a very close agreement with the results given by that ordinarily employed. He believes that the probable error of his method will not exceed 0".02. — (*Comptes rendus*, April 16 and 23.) M. MÇ N. [1063

MATHEMATICS.

Spherical representation of surfaces. — In a series of previous communications, M. Darboux treated the particular case of spherical representation when the spherical images of the lines of curvature form an orthogonal and isothermal system. In the present communication, he shows how the method previously employed conducts to the complete solution of the problem of spherical representation whenever this solution can be obtained in finite terms. Employing certain propositions due to M. Montard, the author arrives at the conclusion that we can obtain all the cases in which the problem of spherical representation is susceptible of a solution in finite terms, and that, whenever the problem of spherical representation has been solved in any manner for a system of orthogonal curves, we can derive from the obtained solution an entire unlimited series of orthogonal spherical systems. — (*Comptes rendus*, Feb. 5.) T. C. [1064

Motion of a material point. — In concluding a paper on a certain peculiar case of the motion of a material point, M. Gascheau considers the problem of finding the equations of motion of a material point acted upon by a central attractive force, varying inversely as the cube of the distance from the point to the centre of action. The trajectory is shown to be an hyperbolic spiral. The curve itself is discussed, and a formula is obtained for its rectification. Special phases of the motion of the point are also investigated. — (*Bull. soc. math.*, x. no. 7.) T. C. [1065

Partial differential equations. — It is impossible to do more than call attention to this memoir by M. Lemonnier, which treats of the integration of partial differential equations of the first order in n independent variables. The process followed is new, and decidedly simple and interesting; but an abstract can scarcely be given here without introducing a good deal of algebraical work. — (*Bull. soc. math.*, x. no. 7.) T. C. [1066

A differential equation. — Capt. MacMahon considers the differential equation,

$$X^{-\frac{1}{2}}dx + Y^{-\frac{1}{2}}dy + Z^{-\frac{1}{2}}dz = 0,$$

where X and Y are cubic functions of x and y respectively. The equation obtained from the above by dropping out the term in z has been investigated by Allegret (*Comptes rendus*, lxvi. p. 1144), who has obtained the integral in an irrational form. If a denote the constant of integration, Allegret's result is symmetrical in x, y, and a. Capt. MacMahon puts a equal to z, and obtains a solution of the above equation in the form of a rational algebraical integral.

Prof. Cayley adds an interesting note to this paper. — (*Quart. journ. math.*, Feb.) T. C. [1067

PHYSICS.

Optics.

Reversal of hydrogen-lines. — Liveing and Dewar communicate to the Royal society an interesting note, showing, that, when the induction-spark is taken between electrodes of aluminium at a pressure of two or three atmospheres, the reversal of *F* is easily obtained; that of *C*, only with difficulty. By spirting fine drops of water with a pipette into the electric arc, the hydrogen-lines become brilliantly, and, so to speak, 'explosively' visible for an instant, but without any reversal. — (*Nature*, May 3.) C. A. Y. [1068

(Photography.)

Iodide of silver in the emulsion. — Herr Schumann has been experimenting on emulsions sensitized by combinations of the iodide and bromide of silver. Capt. Abney, Dr. Eder, and Dr. Vogel found that the introduction of iodide diminished rather than increased the sensitiveness of the emulsion, while Herr Schumann obtained the opposite result. He now finds the cause of this discrepancy to be, that while the former authorities prepared their iodide and bromide emulsions separately, and then mixed them, in order to obtain accurate quantitative results, he has been in the habit of precipitating the two together in one and the same solution, as would be done in the practical working of the process. As prepared by the former method, the emulsion is of a pale yellow color; while, by the latter, it is darker and of a citron-yellow tint. The sensitiveness of the mixed emulsions is at a maximum in that portion of the spectrum lying between *F* and *G*. It has a lower maximum in the vicinity of the *H* line, and is practically insensitive to the region half way between *G* and *h*. The spectrum of the combined emulsion differs from the above in having a distinct maximum between *b* and *F*, and in its much greater sensitiveness to the less refrangible rays. —(*Brit. journ. phot.*, April 27.) W. H. P. [1069

Photographing the vocal organs. — Messrs. H. T. Wood, Behnke, and Cadett have recently succeeded in photographing the vocal organs in action. An electric light and laryngoscope were employed. It was necessary, in these experiments, to so arrange the light, that the singer should at the same time be enabled to see that the mirror was in the proper position, and also that the image was reflected directly into the camera lens. The light was placed by the side of the camera, and a little in front of it; and the rays were directed by means of a condenser upon a mirror placed immediately above the lens; this mirror being set at an angle of 45° so as to direct the light upon the subject. The condenser was furnished on the side next the lamp with a water-jacket, through which a current of water was kept flowing to prevent injury to the lens from the heat of the lamp. The rays from the first mirror were received upon the small laryngoscopic mirror placed at the back of the throat, and the image formed in this was reflected upon another small mirror fixed to the front of a drop-shutter; the object of this arrangement being to enable the person whose organs were being photographed to see when the image was properly directed. When this was done, he gave the signal to the operator, and the exposure was made. In some of the latter experiments, arrangements were adopted by which a pair of stereoscopic lenses could be used, one lens serving as a finder, and the other producing the picture. — (*Brit. journ. phot.*, April 13.) W. H. P. [1070

Electricity.

Resistance of the electric arc. — Ayrton and Perry, experimenting upon the electric arc between carbon poles, employing at times a battery of Grove cells, and at others a Brush dynamo, find, like Schwendler, that the resistance of the arc, including under this head both the resistance proper and the opposing electromotive force at the carbon surfaces, is nearly inversely proportional to the current. The following is given as a sample of the results obtained from a number of tests with Grove cells: —

No. of cells.	Current, in ampères.	Difference of potential between carbons, in volts.	Work, in foot-pounds, per second in arc.
30	6.52	30.4	146.2
40	10.16	30.4	227.8
50	11.92	30.4	267.2

Other experiments showed, that, when a given current was trebled, the difference of potential between the poles was slightly increased. The authors have also tested the relation between length of the arc and the difference of potential between the poles. A large number of experiments were made for this purpose with a Brush machine, giving currents varying between 5.5 and 10.4 ampères, the distance between the carbon points varying between 0 and $1\frac{1}{4}$ inches, and the difference of potentials from 0 to 140 volts, the carbons being 0.24 inch thick. The results are plotted, giving a curve for which the approximate equation is, —

$$E = 63 + 55a - 63 \times 10^{-10a},$$

where E is the difference of potentials in volts, and a the distance between the points in inches. — (*Phil. mag.*, May.) E. H. H. [1071

ENGINEERING.

The steamer City of Fall River. — The steamer City of Fall River, which has been recently added to the Fall River line between New York and Boston, exhibits some decided innovations. The engine, of 2,000-horse power, was designed and built by Messrs. A. & W. Fletcher of New-York City. It is a compound beam engine, fitted with the Morgan feathering paddle-wheels, and supplied with steam by a Redfield boiler, all of which features are unusual. The steam-cylinders are 44 inches diameter by 8 feet stroke, and 68 inches by 12 feet stroke. The wheels are 25 feet 6 inches in diameter. The boilers are of Otis steel, and are tested to 150 pounds pressure per square inch. The boat is 200 feet long, 41 feet beam, 17 feet deep. Over the guards the breadth is 73 feet. The draught of water, loaded with 600 tons of freight, is 12 feet. This steamer has made the 181 miles from port to port in $10\frac{1}{4}$ hours, and has made 17 miles an hour. The coal consumption is small, — 20 tons per round trip. — (*Sc. Amer.*, May 5.) R. H. T. [1072

CHEMISTRY.

(Organic.)

Oxidation of aromatic monamines and diamines. — When equal molecules of dimethylparaphenylendiamine and dimethylaniline in an aqueous solution with zinc chloride were treated with the

quantity of potassic bichromate required to furnish two atoms of oxygen, R. Bindschedler found that the following reaction took place: —

$$C_6H_4{}^{N{}^{CH_3}_{CH_3}}_{NH_2} + C_6H_5N{}^{CH_3}_{CH_3} + O_2 = C_{16}H_{19}N_3 + 2H_2O.$$

Dimethylphenylen green.

Tetramethylphenylsafranine ($C_{22}H_{18}N_4$) resulted when aniline was substituted for dimethylaniline. With two molecules of aniline, dimethylparaphenylendiamine gave dimethylphenylensafranine ($C_{20}H_{18}N_4$). Phenylensafranine was formed in the reaction, —

$$C_6H_4(NH_2)_2 + 2C_6H_5NH_2 + O_4 = C_{18}H_{14}N_4 + 4H_2O.$$

— (*Berichte deutsch. chem. gesellsch.*, xvi. 864.) C. F. M. [1073

A new synthesis of anthracene. — By means of the aluminum chloride reaction, using benzol and tetrabromethan, R. Anschutz and F. Eltsbacher obtained anthracene, —

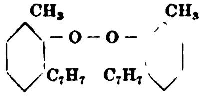
$$C_6H_6 + CHBr_2 - CHBr_2 = C_6H_4\langle{}^{CH}_{CH}\rangle C_6H_4 + 4HBr.$$

—*Berichte deutsch. chem. gesellsch.*, xvi. 623.) C. F. M. [1074

Derivatives of meconic acid. — In Kolbe's laboratory a series of compounds has been obtained by Ost, which he regards as derivatives of the hypothetical body *pyridon* (C_5H_5NO). Pyromekazonic acid $\left(C_6H_3NO{}^{OH}_{OH}\right)$ was made by the action of hydriodic acid upon oxypyromekazonic acid. It resembles the hydrochinones in that by careful oxidation pyromekazon ($C_6H_3NO \cdot O_2$), a substance analogous to the chinones, is formed. When treated with ammonia, comenic acid was converted into comenaminic, $\left(C_5H_3NO{}^{OH}_{COOH}\right)$. Oxycomenic acid gave oxycomenaminic $\left(C_5H_2NO{}^{(OH)_2}_{COOH}\right)$, which, by further oxidation, was converted into azoncarboxylic acid $\left(C_5H_2NO{}^{O_2}_{COOH}\right)$. All the oxygen in comenaminic acid was replaced by chlorine when the acid was heated to 100° with phosphoric pentachloride, with the formation of pentachlorpicoline ($C_5H_2Cl_2NCCl_3$) and hexachlorpicoline ($C_5HCl_3NCCl_3$). Monochlorpicoline (C_6H_5ClN) was the chief product of the reduction of the acid by sodium amalgam. The decomposition products of comenic acid, when treated with phosphoric pentachloride, were perchlormekylen (C_5Cl_6) and hexachlorethan (C_2Cl_6). — (*Journ. prakt. chem.*, xxvii. 257.) C. F. M. [1075

Spontaneous decomposition of oxalic acid. — On allowing a dilute solution of oxalic acid containing .4 to .6 grm. to the litre to stand for several years in a closed vessel, G. Fleury found that the solution lost its acid reaction. Large clusters of a vegetable growth had developed, similar to that often observed in tartaric acid. In a more concentrated solution (6.3 grms. to the litre) there was no appreciable change at the end of four years. — (*Journ. pharm. chim.*, 1883, 388.) C. F. M. [1076

New bodies from coal-tar. — In fractioning a sample of coal-tar, H. Schwarz obtained a distillate between 320° and 330° which solidified. By fractional crystallization he separated three products which melted respectively at 95°, 104°, and 124°. Analysis showed the same percentage of carbon and hydrogen which corresponded to the formula $C_{28}H_{26}O_2$. Oxides of the composition $C_{14}H_{11}O_2$ were formed by oxidation; and by nitration they gave heptanitroproducts. The three substances were therefore designated as α-, β-, and γ-pyrocresols. The name pyrocresol was adopted provisionally, since further study is necessary to establish their constitution. The author thinks they may be forms of a ditolylditolylenoxide, —



— (*Sitzungsberichte kais. akad. Wien*, lxxxvi. 835.) C. F. M. [1077

METALLURGY.

Lead-smelting at Altenau, Upper Hartz. — The low grade of the available lead ores, and the failure of the iron-rich copper slags from Oker, have necessitated a change in the process of smelting. The method now used is as follows: the ores are roasted in a single hearth reverberatory furnace until changed to oxide and silicate of lead, then smelted in a blast-furnace with the addition of 20% of raw ore to make a matte of all the copper. The ore must be crushed quite fine, namely, not over 2 mm. in size, and should contain about 15% of silica to 60% of lead, to give the best results in roasting. The charge for the blast-furnace is planned for a lime-iron slag. The lime-slag, which was at first tried, failed on account of the amount of zinc present. The cost of this process is not much less than the old method; but the Oker residues are at present used elsewhere, and are consequently not available, and, besides this, the furnace smoke is avoided. The process yields 98.5% of the lead, and the yield of silver is larger than the fire assay indicates. — (*Zeitschr. berg-, hütt.- sal. wesen*, xxxi.; *Eng. min. journ.*, March 24.) R. H. R. [1078

GEOLOGY.

The coal and mineral fields of Indo-China. — E. Fuchs, ingénieur en chef des mines, gives a long account, with maps and sketches, of his mission to Cochin-China, assisted by E. Saladin. The following formations are figured on the general map: granitic rocks, porphyritic rocks, volcanic rocks, ancient rocks, carboniferous or Devonian limestone, coal-basins, variegated sandstones and clays. The ancient rocks referred to the Silurian are unfossiliferous. The overlying schists and sandstones are referred to the Devonian; they contain fragments of a large crinoid, and imperfect impressions of a bivalve, probably an Orthis; and they are frequently cut by veins of quartz, which are sometimes auriferous. The carboniferous limestone plays an important part in the geology of Indo-China: it is five hundred or six hundred metres thick, and contains fragments of Zaphrentis; it is a fine-grained, compact, crystalline limestone, and might be utilized as a marble. Resting in discordance of stratification on this, is the thick clay and sandstone formation, which at its base contains the coal-beds whose study has been the chief object of the investigation. The base of the system is characterized by the felspathic nature of its sandstones, and their prevailing gray color. The principal coal-basins actually found are those of Tong-King, of Yun-Nan, of the province of Tinh-Hoa, of Nong-Sön (Annam), and of Laos; notably, that of Bassac, on the Mé Kong. Above the coal-beds come the series of variegated sandstones and clays: their thickness is estimated at a thousand metres; they contain no fossils, but beds of salt-bearing clays, and sandstones impregnated with copper. The upper mesozoic and tertiary beds have not yet been found in Indo-China.

The ancient and modern alluvial deposits are very extensive. The exploration failed to find the zinc and copper localities that were mentioned to them in Tourane, and did not extend so far as to reach the important tin-veins of Laos and Yun-Nan.

Mr. Zeiller, in his study of the fossil flora of the coal-beds of Tong-King, from material brought back by Mr. Fuchs, and in part collected by Mr. Douzans, reports twenty-two species, of which two are new. Out of the twenty remaining, ten are identical with European species, confined exclusively to rhetic beds. Of the remaining species, five belong to the lower Gondwánas, and four to the upper Gondwánas, while one belongs to both. From this there would seem to be strong reason for considering the coals of Tong-King as of rhetic (upper triassic) age, having analogies with the coals of India (Gondwánas), of South Africa (Karoo series). The coal-basin of the Ternera in the desert of Atacama, between Chili and Bolivia, also contained only rhetic species; and in our own country we have probably analogous beds in the Richmond and North Carolina trias (cf. **1086**). — (*Ann. des mines*, (8), ii. livr. 5.) J. B. M. [1079

Glacial depression of Scotland. — R. Richardson reviews all the localities at which arctic shells have been found associated with the drift in Scotland, and shows that arctic species not now living in the British seas have been discovered at various high levels throughout Scotland, ranging from 90 to 510 feet above tide at fourteen stations. At lower levels, such discoveries have been much more frequent. The shells are generally referred to interglacial deposits. A neatly drawn map illustrates the paper (*Trans. Edinb. geol. soc.*, iv. 1882, 179). In the same volume, D. Milne-Home devotes part of his inaugural address to the evidence favoring the iceberg theory, stating, that, when due regard is paid to the general south-easterly transport of bowlders at various parts of the United Kingdom, it is difficult to account for such an extensive operation, except by bergs floating in the sea over the submerged land (*Ib.*, 124). — W. M. D. [1080

Glaciation of Norway. — H. M. Cadell describes the plateau mountains of Norway as an old surface of denudation, now lifted above its former base level of erosion, and greatly roughened by subsequent erosive action. He agrees with Penck in maintaining that there is a fundamental difference between Swiss and Norwegian glaciers; the former originating in sloping fields of *névé*, while the latter are overflows of upland ice-sheets. Three glaciers descend from the ice of the Folgefond, and twenty-three from the great Justedal ice-plateau. These upper sheets are regarded as small examples of the present Greenland ice, and as remnants of what once 'extended over the whole of northern Europe.' The fiords are described as 'most typical examples of true ice-formed rock-basins,' and it is stated that there is no evidence of fracturing or faulting in the rocks about them (although Kjerulf has shown the contrary statement to be true). — (*Trans. Edinb. geol. soc.*, iv. 1882, 227.) W. M. D. [1081

GEOGRAPHY.

(*Alpina.*)

Hygiene of mountain climbing. — Dr. Brenner advocates exercise in the high, fine air of mountains as the best protection against the diseases contracted in city life. The characteristics of the mountain climate are the low temperature and air-pressure, the low relative humidity, the high per cent of ozone, the strong light and insolation, the freedom from dust and bacteria. All these act well on the bodily health. The lungs work with greater strength, the heart beats faster, the blood circulates more quickly, appetite is increased, perspiration becomes freer, the muscles become more energetic, and the whole body gains in strength and endurance. — (*Mittheil. deutsch. oest. Alpenv.*, 1882, 284.) W. M. D. [1082

Geographic nomenclature. — A chapter of definitions of Alpine words used in Trient is contributed by Apollonio, with a valuable pictorial supplement of thirty-seven figures, showing as many types of mountain form. Six cuts illustrate passes, and sixteen are given to peaks, the latter being chiefly of the acute form characteristic of the dolomites. Unfortunately it is not specified whether the figures are taken from nature. The style of work may be commended to our own mountain clubs. — (*Ann. soc. alp. trident.*, viii. 1882, 329.) W. M. D. [1083

(*Arctic.*)

Arctic notes. — Kumlein's researches among the Eskimo of Cumberland Inlet during the Howgate expedition are summarized and reviewed in the *Deutsche geographische blätter*, heft ii. 172–178. —— For the promotion of traffic with Siberia, it is proposed to construct a canal in about latitude 58°, connecting the Yenisei and the Ket branch of the Obi River. The distance is about twenty miles from water to water, but much improvement of the Ket, and a small branch of the Yenisei called the Kas, will be necessary before through navigation will be practicable. An investigation by official engineers is in progress; and, if the difficulties are no greater than anticipated, the work can be rapidly finished, and at a reasonable cost. At present, there are more than fifty steamers on the Obi, while in 1854 there were but two. —— The U. S. coast-survey has issued several new charts of the Alaskan coast. One covers part of the coal-fields of Cook's Inlet, and several glaciers bordering on Kachekmak Bay; another includes the codfishing grounds of the Shumagins, the sea-otter region of the south shores of Aliaska peninsula, and the peninsula itself from Coal Cape to Issannakh Strait. It is partly compiled from published data, but includes much new and important information on both sides of the peninsula. —— The position which should be taken by Germany, in regard to polar research, was discussed at the first day's meeting of the German geographers at Frankfurt, in March. —— Karl Pettersen has printed a scheme for international polar expeditions, which includes stations at Bering Strait, North Spitzbergen, and the north-east coast of Novaia Zemlaia, which should be occupied during summer, for ten years, making observations, watching the changing character of the seasons each year, making short expeditions northward, and annually visited by recruiting vessels, which should bring back the staff of observers at the end of the season. Something of this kind has been done by the more intelligent traders and whalers who annually visit these seas, but whose observations are rough, not comparable, and often lost entirely. Still more near to Pettersen's idea is the plan adopted by the Dutch, whose little schooner, the Willem Barents, has just sailed on her sixth cruise in the arctic European seas, and has each season brought back carefully systematized and comparable observations. —— The fourth number of the *Mittheilungen* of the international polar commission contains a number of notes and letters from various stations. The Lena station, on Sagastir

Island, is comfortably housed on the right bank of the Sagastir mouth of the river in latitude 73° 22′ 30″ north, and east longitude 126° 34′ 56″. Firewood and whitefish were abundant. November was very clear, with little snow, which interfered with reindeer-stalking. Dr. Bunge, the surgeon, had the misfortune of breaking a rib through a fall, but was doing well, and was visited by many Tungusi, who wished for medical advice. —— The last number of the Irkutsk bulletin contains four months' observations of the temperature of the air, by Ivan W. Pavloff, an exile, at the village of Marsha, the period covering August to November, 1882. —— A communication from the Danish ministry to the Parliament gives an account of the condition of the colonies in West Greenland for the year 1882. —— It is stated that the plans of Dr. Boas for his studies of the Innuit of Cumberland Inlet and vicinity embrace a visit this fall to Iglulik, and a return to Cumberland Inlet *viâ* the unknown west shores of Baffin Land, wintering at the station; and, next year, an investigation of the little-known tribe of Eclipse Sound and Pond Inlet, returning by the most convenient whaleship. — W. H. D. [1084

(*South America.*)

Bove's Patagonian voyage. — Lieut. G. Bove gives a narrative of his unfortunate voyage southward from Montevideo, whence he sailed Dec. 25, 1881, to Santa Cruz, on the eastern coast of Patagonia, Staten Island, the easternmost of the Fuegian Archipelago, and other islands near Cape Horn, until his wreck in Hammacoja (Sloggett's Bay) on May 31, 1882. Santa Cruz is described as the fittest centre for the population of southern Patagonia, having a tolerable anchorage, and fair supply of water and wood, and a climate not too severe. But it is a poor place at best; for the surrounding country is dry and desolate, and the strong currents are continually shifting the sand-bars in its river-channel. The spring tides rise 16 met., and produce a violent bore. Forty days were given to a careful exploration of Staten Island: it is very mountainous, with peaks rising to 850 met., and a deeply indented shore-line; its rocks are mostly schists and quartzites, with nothing more recent than carboniferous strata; evidence of glacial action is distinctly found in old moraines and numerous lakes; and peat bogs of great area occur not only near sea-level, but on the mountain flanks as well. Further description of this region may be given in later reports. The islands next explored near Cape Horn are seldom visited; and one regrets to find so little description given of them in Bove's account, although as a simple narrative it possesses much interest. While the southern islands were extremely barren, a better country was found farther northward along the deep fiords; as, for example, about the successful English mission at Ustchiuvaja, — a fine site, with good anchorage, and sufficient wood and water, and pasturage for cattle, on the On-astchiaga (Beagle Channel). Bove compares the snowy Sarmiento peak (2,300 met.) to the finest of Alpine scenery: it gains from contrast with the sea what it loses in absolute height. Extended glacial action is often referred to; but, in the mention of rounded rocks and abandoned moraines, there is again need of more definite statement. Recent glacial retreat was shown by the interval of 100 met. between the foot of the Negri glacier and its nearest terminal moraine. The final wreck of the vessel was occasioned by the selection of an anchorage, unprotected on the southeast, where a rising storm exposed it to such severe weather and waves, that it was hastily decided that the only chance of safety lay in running ashore. This was accomplished without loss of life, and much was saved from the stranded vessel. After five days' waiting, their only boat was launched, and a few men returned in it to the English mission aboved named, whence the mission vessel, Allen Gardiner, was at once despatched, and rescued the entire party on June 10, after they had been somewhat disturbed by a band of natives. A rough outline map, and some views of doubtful accuracy, are among the few illustrations; those of the Fuegians, accompanying the author's special description of the Jagan tribe of the southern islands, being much better. Reports on zoölogy, botany, and geology, by Vinciguerra, Spegazzini, and Lovisata, all members of the expedition, give information of technical value (cf. **1100**). — (*Boll. soc. geogr. ital.*, viii. 1883, 5, 89.) W. M. D. [1085

(*Asia.*)

Indo-China. — A successful search in certain parts of this peninsula for coal, iron, and gold, gave M. Edmond Fuchs opportunity to note some of its physical peculiarities. Its larger features are: the valley of the Red River (Song-ka) or Tonking, fertile and open, occupied by 12,000,000 inhabitants, and containing valuable coal of early mesozoic age; next westward, the granitic plateau of Laos (Annam), flanked with ranges of ancient slates, abruptly descending to the coast on the east, and with a long slope to the west into the valley of the Mekong, — a great river 1,800 miles long, with a rapidly growing delta, which is included in French Cochin-China. The daily discharge of this stream is estimated at almost 4,000,000,000 cubic metres, with a thousandth part of silt. By the extension of the delta, an old bay between mountain spurs on the north-west has been shut off, and now appears as the great Cambodian Lake, nearly two hundred miles inland. At the time of high water, the Mekong rises some forty feet, and reverses the current in the lake's outlet, flooding it with muddy water, and thus filling the lake from its lower end. Interesting notes are added on the native population, and further details are given on the geology and mineral resources of the vast region (cf. **1079**). — (*Rev. scient.*, 1883, 482.) W. M. D. [1086

BOTANY.

Experiments upon variation in plants. — In the botanical garden in Giessen, Prof. H. Hoffmann has conducted for many years an interesting series of researches upon variation, the results of which have been published from time to time, with little or no comment. The last notice gives a few facts relative to constancy of color, which may be briefly stated as follows: Adonis aestivalis, pure red, self-sown for 15 years, 410 plants in 15 generations, without any change of color; same species, yellow variety, no change in 13 generations.

Hieracium alpinum is regarded by Kerner as a plant which cannot thrive on a lime soil. Hoffmann obtained, however, good seeds from specimens grown in soil rich in lime, and afterwards carried on a series of observations relative to the variation of the species in soil both with and without lime. He found the widest variability as regards the branching and leaves; but, with the most divergent forms, he had also in every generation a few perfectly typical plants. — (*Bot. zeit.*, April, May.) G. L. G. [1087

Pollination of Rulingia. — According to Urban, several species of this Australian genus of Byttneriaceae possess curious adaptations to crossing by insect aid. The flowers are small (one cm. or less in di-

ameter) and whitish. The pistil secretes nectar, which collects about it or in the hollowed petals. At first the stigma is closely covered by five dilated staminodia, closely inflexed over it for a time, but later separate. In R. pannosa there is well-marked protandry, the staminodia not separating, nor the stigma maturing, until the stamens are all dehiscent. R. corylifolia, on the other hand, is synacmic, the expansion of the sepals and the dehiscence of the stamens occurring in regular succession, and being closely followed by the successive removal of the staminodia from the mature stigma. R. parviflora is intermediate between the two species already mentioned. Its flowers assume a rosy color with age, like those of Trillium grandiflorum, Weigelia, etc. — (*Sitzungsb. deutsch. bot. ges.*, 1883, i.) W. T. [1088

Pinus koraiensis Sieb. and Zucc. — Through the kindness of Chief Engineer G. W. Melville, U.S.N., Mr. Josiah Hoopes had received some specimens of this interesting species of pine collected during the voyage of the unfortunate Jeannette. They consist of a branch clothed with foliage, two immature cones, and a few mature seeds from eastern Siberia. The trees were seen along the banks of the Lena, the Yenisei, and the Obi rivers, growing to a height of about thirty feet, with trunks about ten inches in diameter at base. The collector further states that it fruits abundantly, and that the edible seeds are used by the natives as food, and by travellers as nuts. It is interesting to note that this heretofore comparatively rare species has a wider habitat, and is more numerous, than has generally been supposed. Siebold found it in Kamtchatka, and various authors have described it in the list of Japanese Coniferae as a rare introduced species.

This nut-bearing pine is well marked throughout, and especially so in its cones and seeds, the latter being wingless, sub-angulate, flatly compressed, leaving on both sides of the scale, when removed, remarkably deep impressions. The cones are very distinctive, with long reflexed scales, terminating in an abrupt mucro-like apex. Murray, in his Pines and firs of Japan, records its height as from ten to twelve feet; but Parlatore, on the authority of Perfetti, gives it as 'sometimes thirty to thirty-three feet.' The latter is corroborated by Mr. Melville, thus indicating that the tree is a true northern species, attaining its greatest size only near the extreme limits of arboreal vegetation. It will, no doubt, make a valuable addition to our list of ornamental conifers, as its hardiness is unquestioned, and the foliage is as attractive as any other of the white-pine group, with the exception, perhaps, of P. excelsa. In England it has proven reliable, and the small plants cultivated by Mr. Hoopes show evidences of success. — (*Acad. nat. sc. Philad.; meeting* May 8.) [1089

ZOÖLOGY.

Coelenterates.

Recent researches upon the Pennatulida. — As the result of a prolonged study of Renilla, Dr. Wilson gives a brief summary of his results and conclusions upon the following topics : the segmentation of the egg and the formation of the germ-layers, the formation of the organs and tissues of the axial polyp, the origin of the community by budding from the axial polyp, the significance of the polymorphism and bilateral symmetry of the community.

During segmentation the division of the nuclei appears to be nearly regular; but the vitellus may either divide with the first division of the nuclei, or it may remain at rest until a much later stage. In some eggs the first division of the vitellus was into thirty-two spheres. After segmentation the ectoderm is separated by delamination from the solid central endodermic mass, and the supporting layer is secreted from the inner ends of the ectoderm-cells.

The gastric cavity, which has at first no communication with the exterior, is formed by absorption of the central endoderm-cells by those which are more peripherally placed, and the oesophagus is formed as a solid invagination of ectoderm. Its central end is not simply perforated, but absorbed, during the formation of the mouth. The peduncular septum consists of three layers of endoderm-cells, and the author therefore believes that it is morphologically a fused pair of septa. The muscles are developed as processes from the bases of the endoderm-cells; and the cell-body, in many cases at least, becomes reduced to a small granular mass enclosing the nucleus, and closely applied to the side of the muscular fibre. The apicules are developed in the interior of cells, and are of two kinds (ectodermic and endodermic), which differ much in form and size.

The buds which are to form the sexual polyps are developed along the axial polyp in pairs, as two simple lateral rows, and each of them soon becomes a secondary axis for two rows of buds which appear in the angles between the older buds. The law of budding is the same for the zooids and polyps.

The hauptzooid is formed at an early stage as a median bud upon the axial polyp; and its function is to discharge water from the colony, while the other zooids draw in water, as do also the young sexual polyps, but not the adults. Wilson therefore concludes that the zooids are homologous with young sexual polyps; that they are polyps in a state of arrested development. He believes that the polymorphism of the community has not been brought about by the gradual specialization of an undifferentiated community, but that the ancestors of the zooids never possessed a higher organization than at present. He believes that the bilateral symmetry of the community has been directly determined by the bilateral environment, and he holds that Renilla is descended from a form like the Bathyptileae, and not, as Kölliker believes, from a primitive simple 'Archyptilum.'

The paper is an abstract of an extended monograph which is to be published in the *Phil. trans.*; but the author is an American naturalist, and the researches were made upon the coast of North Carolina. — (*Proc. royal soc.*, no. 222.)

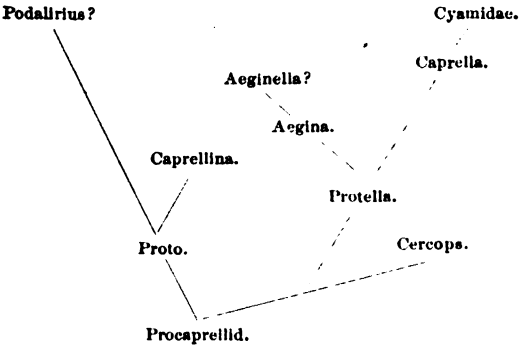
Living specimens of the very rare genus Funiculina have been obtained near Lisman Island, and they have been observed and studied by A. Milnes Marshall and William P. Marshall. The immature or young specimens have all the characteristics of Funiculina Forbesii (Verrill), while the full-grown ones are typical specimens of F. quadrangularis (Pallas); and the authors therefore reject Verrill's identification of the northern form as a new species. The paper contains a revision of the literature of the Pennatulidae, and an account of the general anatomy of Funiculina, Virgularia, and Pennatula, but it adds very little to the researches of Kölliker and others. — (*Rep. Oban Pennatulidae.*) W. K. B. [1090

Hydro-medusae without digestive organs. — Dr. Lendenfeld describes a new sub-family of hydroids, Eucopellinae, in which the medusa has no digestive organs, and lives only a short time after its escape from the genophore. Only one species, Eucopella campanularia, is known, and this is found in Australia. The larva is a campanularian whose hydranths are carried upon short, unbranched stems, which

spring from a creeping root. The medusa has a veil, well-developed marginal sense-organs, radial and circular chymiferous tubes, and large reproductive organs, but it has no mouth, stomach, or tentacles. It discharges its reproductive elements within twenty-four hours after its liberation, and it lives only about thirty-six hours. — (*Zool. anz.*, April 16.) W. K. B. [1091

Crustaceans.

Monograph of the Caprellidae. — In the sixth of the series of beautiful zoölogical and botanical monographs published by Dr. Dohrn's station at Naples, Dr. Paul Mayer treats of the bizarre crustaceans belonging to the family Caprellidae. The systematic part of the work (pp. 16–90) is the most important, being not barely descriptions of the species found in the Bay of Naples and its neighborhood, but a revision of all the known species of the world. The systematic part is followed by an account of the anatomy, histology, and habits. The few pages (165–168) devoted to development do not add much to the little previously known through the studies of Gamroth. Mayer concludes that the families Cyamidae and Caprellidae are closely related, and form a natural group, Laemodipoda; that the Cyamidae are a later group than the Caprellidae, and are derived from a genus very near Caprella; that the Laemodipoda form a group of the Amphipoda, and are most closely related to the gammaroid Amphipoda. The author's conception of the relationship of the eight known genera of Caprellidae is expressed in the following genealogical tree.



As nothing is known of the paleontological history of these animals, and but little of the development, this phylogeny is founded almost exclusively upon the adult structure. The species found in the Bay of Naples, together with anatomical and histological details, are figured on ten lithographic and photolithographic plates. — (*Fauna u. flora golfes Neapel*, vi. 1882.) W. F. [1092

Insects.

Color-preferences of insects. — Müller gives a general *résumé* of the results so far reached, with a brief account of the literature. — (*Biolog. centralbl.*, 1883, no. 4.) W. T. [1093

Illustrations of American butterflies. — In the eleventh part of his Butterflies of North America, Mr. W. H. Edwards furnishes plates of more than usual interest, and of a fidelity to nature which we have come to expect from this source. They have, indeed, never been surpassed, and it would be difficult to point out an error of delineation. The plates of this particular number do not show such a wealth of varietal illustration as some of the previous ones; but each of them presents new biological features. The first represents four species of Pieris, with larva and chrysalis of two of them (Sisymbri and Beckeri) from drawings made in southern California by Mead; the egg of the former is also given. The second plate is entirely given to Limenitis Eros, and illustrations are given of every stage of the larva (seven figures), of the egg and chrysalis, besides enlarged drawings of the details of structure in the larva. Considerable space is given to the natural history of the insect, largely from the observations of Wittfeld in Florida; its relations to L. Disippus are also discussed, as far as the preparatory stages are concerned.

The third plate has the highest interest, because we are for the first time introduced to the natural history of any of our native erycinid butterflies. Through the efforts of Mr. Doll at Tucson, Arizona, Mr. Edwards has been able to trace and figure the entire history of one and the earliest stages of another species of Lemonias, feeding naturally on mesquite (Prosopis juliflora), but which he managed to raise in West Virginia on wild plum, after repeated failures on other plants. Of L. Nais, three figures are given of the egg, or parts of the egg, seven of the four stages of the larva, besides four plain figures of structural details, two of the chrysalis, and four of the butterfly; of L. Palmerii, the egg, young larva, and butterfly are figured. These figures show the larva to have a head scarcely smaller than the body behind it, partially covered by, but not, as in lycaenid butterflies, retractile within, the segment following; to be clothed, when just from the egg, with long sweeping hairs, and in after life by clusters of short spreading hairs arranged in longitudinal rows, continuous without deviation over thoracic and abdominal segments. Neither egg nor chrysalis shows any difference of importance from lycaenids. Another number will complete the second series (or volume) of this excellent iconography. [1094

Fossil insects from Greenland. — Heer describes and figures a fragment of a large elytron from the cretaceous beds of Ivnanguit, besides a small series of tertiary insects from Atanekerdluk and Haseninsel. Five of these are elytra of Coleoptera of various families, one a Locusta compared to L. viridissima of Europe, and one a fragmentary Phryganea. Two other new fossil Phryganeae are also figured from Parschlug and from Aix, and a Helops from the Molasse of Lausanne. The number of tertiary insects so far found in Greenland is recorded as thirteen. — (*Heer's Flora foss. groenl.*, ii. 143, pl. 109.) [1095

VERTEBRATES.

Fish.

New southern marine fish. — Descriptions of twenty-five new fish from the southern United States have been published by Messrs. G. B. Goode and T. H. Bean. The new generic forms are of special interest. Ioglossus is a Gobiid allied to the Chinese Oxymetopon of Bleeker, although apparently not so 'closely' as supposed by the authors. It is much less compressed than Oxymetopon, has no keel on the head, and almost all the scales are cycloid. The individuals described were obtained at Pensacola, Fla. Chriodorus is a Hemirhamphine closely related to Arrhamphus, — so closely, indeed, that the differences between the two (if any) remain to be shown. The two have not been compared by the authors. The new type, C. atherinoides, was obtained at Key West, Fla. Letharchus is a new Ophisurid nearly related to Sphagebranchus, but differing externally by the

absence of an anal fin. Its species, L. velifer, was discovered in West Florida, and attains a length of about a foot and a half. Among the other noteworthy novelties, a new species of Porgy (Stenotomus caprinus) is also described from two specimens found in stomachs of the Red Snapper at Pensacola. — (*Proc. U. S. nat. mus.*, iv. 412.) T. G. [1096

Characters of the centropomids. — The family Centropomidae has been diagnosed by Theo. Gill. Its most marked distinctive characters seem to be the elongation of the postorbital portion of the skull, 'a well differentiated posterior oblong, pentagonal, or hastiform area,' resulting from constriction of the parietals near their middle, and peculiarities of the vertebrae and their apophyses. —(*Proc. U. S. nat. mus.*, iv. 484.) [1097

Mammals.

The bottle-nosed whale. — Capt. David Gray, through the agency of Prof. Flower, has recently made known, in a brief but interesting manner, the results of some observations on the whales of the genus Hyperoödon. It appears that the male bottle-nosed whale undergoes great changes in form with age, particularly as regards the head. The shape of this part of the body in females and young males is similar, the plane of the forehead making an acute angle with the plane of the mouth. As the male grows, however, the forehead becomes more and more prominent, and in old age its anterior surface stands at right angles with the plane of the mouth. Prof. Flower makes use of these observations to reduce the species hitherto recognized to a single one. — (*Proc. zoöl. soc. Lond.*, 1882, 726.) F. W. T. [1098

Development of the intermaxillary bone. — In an article published with great luxury of type and illustration, Th. Kölliker gives the results of his investigations on the intermaxillary bone, and the development of harelip and cleft palate. The memoir is one of special interest to the dentist and surgeon. We may mention here the following conclusions: 1. Since the human embryo has a separate intermaxillary, we may consider the same to be a typical structure in facial clefts; 2. The intermaxillary is composed of two bones; 3. The united bone is destined to carry the four incisors, and many of the irregularities of the teeth in position and number are due to the fact that they are developed independently of the bones destined to carry them. For further details we must refer to the original, which only partially comes within the scope of this journal. — (*Nova. acta. acad. nat. cur.*, xliii. 325.) C. S. M. [1099

ANTHROPOLOGY.

Bove on the Fuegians. — An interesting account of the Fuegians has appeared at Genoa under the auspices of the committee of the Italian antarctic expedition. It is prepared by Bove, and illustrated by a geographical chart of Tierra del Fuego and Patagonia, and an ethnological chart showing the distribution of the different races inhabiting the Land of Fire. The latter are divided into two very distinct stocks, separated by Admiralty Sound and Beagle Channel. The Ona reside on the east and north of these passages, on the largest of the Fuegian Islands, and comprise about two thousand souls. To the west and south are the Yamana (Jagan), a race comprising about three thousand, and the Alkaluf, about as many more. These people, perhaps of identical origin, now form two well-differentiated races, who are constantly at war. The Ona and Alkaluf have a rough and guttural language, while that of the Yamana is soft, and rich in vowel-sounds. A very vivid description of the character of the Fuegian country and of its people is given by Bove, who describes their distribution, physical characteristics, habits, dress, and wanderings; their birch-bark canoes, with which they brave storms, and pursue the seals and even whales; the wretched position of the women, who are practical slaves, living in polygamy, and yet unusually fertile, though a majority of the children succumb to exposure and insufficient food; their marriage customs, and treatment of their families, which appear to be chiefly remarkable for a stony selfishness unmitigated by affection or pity on the part of the males; their Shamanism and blood-revenge, the latter strictly on Mosaic principles; their weapons, camps, and ornaments; the treatment of the dead, linguistics and the ameliorating influence of the faithful missionaries in that desolate land. The language appears, like that of many barbarous peoples, to be rich in words. Over thirty thousand vocables are enumerated in the Yamana tongue, besides agglutinations. They appear to have no reverence for the dead. One fellow sold his father's skull to Bove, and wished it a pleasant journey over the sea (cf. **1085**). — W. H. D. [1100

Aboriginal soapstone-quarries. — Not many years ago the occurrence of copper, mica, and soapstone vessels in the Indian graves of our eastern states pointed, it was supposed, to a vast aboriginal commerce, embracing the whole continent in its network of communications. The researches of practical archeologists, however, are constantly bringing to light new sources of supply, that were formerly worked much nearer to the mounds and graves where their productions found their last resting-place. The finding of many half-finished pots and rude tools at Chula, in Virginia, was soon followed by the discovery of several large soapstone-quarries in the District of Columbia. To the subject of this class of Indian work, Mr. J. D. McGuire of Ellicott City, Md., has given much attention. He has found soapstone-quarries in Maryland, and, after considerable research, has discovered the methods of this aboriginal handicraft. — (*Amer. nat.*, June.) J. W. P. [1101

Words for color. — Lazarus Geiger, in one of his suggestive lectures, attempts to show that sense-perceptions have had a very recent evolution by tracing downward from the Homeric poems the terms employed to designate color. A very much more learned discussion of the same subject is that by Prof. Thomas R. Price, respecting the color-system of Virgil. In this essay it is not maintained that the words for color indicate the state of the color-sense, but the adaptation of language to the color-perceptions of the eye.

What idea had the ancients of color? Certainly they did not hold it to be a subjective sensation produced by three sets of nerves within the eye by three kinds of waves differing in length. Rather, in the Indo-Germanic languages, the color of a thing is the cover or skin that overlies or hides the true substance.

In nature, seen under ordinary daylight, there are for the healthy human eye about eleven hundred distinguishable colors. For a hundred and two of these, Roget has names; but the number of color-names in modern French is said to be not short of five hundred. Alma Tadema reproduces his color-impressions of the antique world by a palette of twelve colors, while the palette of Virgil's vocabulary contains twenty-seven terms of high colors, and fifteen more for shades due to excess or deficiency of illumination.

An ingenious set of comparisons leads the author up to the ratio of the occurrence of each set of color-terms to the entire eleven hundred. "His perceptions of color are clearest and strongest in the middle of the spectrum; even in his sensuous imagination, he is temperate and reserved, avoiding the extremes of sensation, and dwelling by preference upon the mean terms, the *media via* of visual perception."

Prof. Price draws attention to the striking coincidence of scientific accuracy with prophetic genius in the phrase of Virgil, *Mille coloribus arcum* (*Ecl.*, v. 609), and the discovery of Aubert (*Rood*, p. 40), that in the solar spectrum the unaided eye may distinguish a thousand colors. The following terms are traced to their origin, and their fundamental idea fixed: ruber, rutilus, sanguineus, cruentus, sandix, minium, ferrugo, roseus, viridis, vitreus, hyalus, igneus, spadix, flavus, fulvus, croceus, luteus, aurum, cereus, pallidus, lividus, caeruleus, purpureus, puniceus, murex, ostrum, albus, candidus, niveus, argenteus, lacteus, marmoreus, decolor, canus, glaucus, ater, niger, fuscus, fumeus, pullus, piceus. — (*Amer. journ. phil.*, v. 1.) O. T. M. [1102

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Smithsonian institution.

Explorations in Louisiana. — Capt. R. W. Shufeldt, medical corps U. S. A., has, since October last, assisted by grants from the Smithsonian institution, been exploring the country in the vicinity of the city of New Orleans, La. The collection that this officer has made has just been forwarded to the institution at Washington. It consists of some three thousand specimens of very interesting forms of the representative vertebrates and invertebrates of that region, besides the contents of the Indian shell-mound situated in the rear of Carrolton, — an antiquity suspected to exist by Foster, from reports he had heard when engaged in his explorations in that locality. Among the vertebrates, some very uncommon forms of bats have been forwarded, and six or seven specimens of the rare Bascanium anthicum, and one of the Aspidonectes asper, the soft-shelled turtle, so eagerly sought after by collectors. Of the fish, Dr. T. H. Bean, curator of the department of fishes at the Smithsonian institution, says, "Two of the determinations are uncertain. The examples of Lepomis 32410 and 32419 are so small that I cannot be sure what they are, the lower pharyngeals being little developed, and with incomplete dentition; 32412, 32414, and 32420 agree with the published descriptions of Zygonectes chrysoties Günth., but they may represent a species quite distinct from that. I will try to get fuller information about Günther's types through some one of my friends who will visit the British museum next summer. The species called Mollienesia latipinna would be regarded as M. lineolata by our friends, Jordan and Gilbert; but I think your series will prove that lineolata is not distinct from latipinna; and, as latipinna is the older name, we should use it.

"The lot of Elassoma zonatum (32423 = No. 108) is the largest and finest ever known in this museum, and there is no probability that any collector has secured a better series. The range of variation is greatly extended by them, and a new locality is found. O. P. Hay had the species from Mississippi; it is known, also, from Alabama, Texas, and South Illinois."

Dr. Shufeldt will work this material up for publication by the Smithsonian institution as soon as the opportunity offers.

STATE INSTITUTIONS.

State university of Kansas, Lawrence.

Weather report for May. — This month had the largest rainfall, the greatest aggregate wind-velocity, and, with one exception (1882), the lowest mean temperature, recorded in any May of our sixteen years' observations. The light white frost of the 22d did no damage to vegetation, and the growing crops are in prime condition at the close of the month.

Mean temperature, 62.05°, which is 4.08° below the average May temperature. The highest temperature was 91°, on the 2d; the lowest was 39°, on the 22d; monthly range, 52°: mean temperature at 7 A.M., 56.19°; at 2 P.M., 71.13°; at 9 P.M., 60.45°.

Rainfall, 7.63 inches, which is 3.56 inches above the May average. There were five thunder-showers. Hail accompanied the rain of the 13th without damage at this station. On the 13th the rainfall was three and one-half inches, which daily register has been but twice exceeded in the past sixteen years. Of this amount, two inches fell in one hour and three-quarters, from 3.45 to 5.30 P.M. The entire rainfall for the five months of 1883 now completed has been 14.07 inches, which is 2.25 inches above the average for the same period in the past fifteen years.

Mean cloudiness, 47.63% of the sky, the month being 1.75% clearer than usual. Number of clear days (less than one-third cloudy), 11; entirely clear, 3; half-clear (from one to two thirds cloudy), 14; cloudy (more than two-thirds), 6; entirely cloudy, 3; mean cloudiness at 7 A.M., 46.77%; at 2 P.M., 56.45%; at 9 P.M., 39.68%.

Wind: N.W., 25 times; S.E., 20 times; S.W., 16 times; S., 14 times; N.E., 13 times; W., 3 times; N., twice. The entire distance travelled by the wind was 15,661 miles, which is 3,334 miles above the May average. This gives a mean daily velocity of 505 miles, and a mean hourly velocity of 21.04 miles. The highest velocity was 60 miles an hour, on the 13th.

Mean height of barometer, 29.010 inches; at 7 A.M., 29.017 inches; at 2 P.M., 28.989 inches; at 9 P.M., 29.029 inches; maximum 29.355 inches, on the 5th: minimum, 28.496 inches, on the 13th; range, 0.859 inch.

Relative humidity: mean for month, 64.5; at 7 A.M., 75.3; at 2 P.M., 45.9; at 9 P.M., 72.3; greatest, 100, on 13th; least, 14, on the 9th.

NOTES AND NEWS.

The American association for the advancement of science will hold its thirty-second annual meeting at Minneapolis, Minn., Aug. 15 and following days. The president-elect is Prof. C. A. Young of Princeton, and the following is the list of the general officers of the meeting: section A (Mathematics and astronomy), vice-president, W. A. Rogers of Cambridge; secretary, W. W. Johnson of Annapo-

lis. B (Physics), vice-president, H. A. Rowland of Baltimore; secretary, C. K. Wead of Ann Arbor. C (Chemistry), vice-president, E. W. Morley of Cleveland; secretary, J. W. Langley of Ann Arbor. D (Mechanical science), vice-president, DeVolsen Wood of Hoboken; secretary, [to be chosen at meeting]. E (Geology and geography), vice-president, C. H. Hitchcock of Hanover; secretary, A. A. Julien of New York. F (Biology), vice-president, W. J. Beal of Lansing; secretary, S. A. Forbes of Normal. G (Histology and microscopy), vice-president, J. D. Cox of Cincinnati; secretary, C. Seiler of Philadelphia. H (Anthropology), vice-president, O. T. Mason of Washington; secretary, G. H. Perkins of Burlington. I (Economic science and statistics), vice-president, F. B. Hough of Lowville; secretary, J. Cummings of Evanston. The permanent secretary is F. W. Putnam of Cambridge; the general secretary (of the meeting), J. R. Eastman of Washington; assistant general secretary, Alfred Springer of Cincinnati; and the treasurer, William Lilly of Mauch Chunk.

The headquarters of the association will be at the State university; the hotel headquarters of the permanent secretary, the Nicollet House. Members expecting to attend the meeting are requested to notify the local secretary, Prof. N. H. Winchell, Minneapolis, as early as possible. Badges of membership will be distributed to all who register.

The following are the principal officers of the local committee. Chairman and treasurer, Hon. George A. Pillsbury; secretary, Prof. N. H. Winchell; and chairmen of the several sub-committees, as follows: invitations and reception, President W. W. Folwell; finance, J. C. Seeley, Esq.; transportation and excursions, Thomas Lowry, Esq.; entertainment, hotels, lodgings, and luncheons, Hon. A. C. Rand; rooms and places of meetings, Hon. Eugene M. Wilson; printing, David Blakely, Esq.

— The annual meeting of the Society for the promotion of agricultural science will be held in Minneapolis, Aug. 13 and 14, just previous to the meeting of the American association.

— It is announced that Lieut. Schwatka, accompanied by Assistant Surgeon Wilson, C. A. Homan, U. S. engineer corps, and three private soldiers, left for Chilkat, Alaska, May 22, from Portland, Or., on the steamer Victoria. They are provisioned for a six-months' cruise, will employ Indians for packers, etc., and intend to ascend the Chilkat River to its head, make the passage to the head waters of the Lewis River, and descend the same to its junction with the Yukon, and descend the Yukon River to its mouth. It is said to be their intention to survey the course of these rivers; and there is no doubt that a properly qualified and equipped party would find abundance of useful work ready to their hands. The whole route has been travelled before, but not by persons in search of, and qualified to obtain, geographical information, except in very small part. The explorations of the Krause brothers on the Chilkat and vicinity have been alluded to before. The Yukon has been superficially examined by McMurray, Ketchum, Zagoskin, Dall, Whymper, Raymond, Nelson, and others, and a few points have been astronomically determined; but nothing like an exact map has been attempted, nor do the data for it exist. Astronomical and magnetic observations anywhere along its banks, and especially any data for a map of the Lewis River and its feeders (which are only known from the reports of prospectors and natives), would be of the highest interest.

— The treasurer of the American committee of the Balfour memorial acknowledges the following additional subscriptions: Prof. L. A. Wait, Cornell university, $5; Dr. M. J. Roberts, post-graduate medical school, New York, $5; Prof. E. A. Birge, University of Wisconsin, $10; Adam Bruce, Princeton college, $4; W. M. Rankin, Princeton college, $2; W. B. Scott, Princeton college, $10; Lyceum natural history, Williams college, $5; classes '83 and '85, Williams college, $10; S. F. Clarke, Williams college, $10; Warren E. Dennis, Newark, N.J., $4; Abraham Jacobi, New York, $10; T. M. Prudden, New York, $5; L. Waldstein, New York, $10; William H. Welch, New York, $10; Miss G. A. Lewis, Philadelphia, $1; Joseph Leidy, Philadelphia, $4; C. S. Minot, Harvard medical school, $5; E. Burgess, Boston society natural history, $5; J. B. Steere, University of Michigan, $4; A. Winchell, University of Michigan, $7; Students' literary department, University of Michigan, $5.70. Previously acknowledged, $518.25.

— Mr. A. H. Keane, whose recent appointment as lecturer in Hindustani, at University college, London, has been raised by the council to full professorship, 'in consideration of Mr. Keane's great eminence as a scholar,' has just issued a prospectus for a work entitled 'A classification of the races of mankind,' which will form two large octavo volumes of about six hundred pages each. He aims in it to provide the student of ethnology with a comprehensive treatise on the races of mankind, which shall correspond with the present state of anthropologic knowledge, and supersede all previous attempts of this sort, however well done. To use his own words, "In the general introduction such broad questions will be dealt with as the evolution of man, the antiquity and specific unity of the species, the present varieties of mankind, the physical and moral criteria of race, the fundamental human types, their evolution and dispersion, the peopling of the continents, the origin of articulate speech, the morphological orders and families of speech, the problem of specific linguistic diversity within the same ethnical group."

He will then deal with the great physical divisions of the human family, discussing each of its

main sections under three separate heads, — first, the physical and moral characteristics of the type; second, the main branches of each (under this head the classification will be carried out); third, an alphabetical index which will form a complete ethnologic gazetteer, collecting all known races, tribes, and languages under short descriptive titles, alphabetically arranged, and full of references to authorities. The Asiatic domain alone furnishes, according to Mr. Keane, some four thousand entries.

The work will be published only upon the condition of there being five hundred subscribers.

— The annual meeting of the American academy of arts and sciences was held in Boston, Tuesday, May 29. The following officers were elected for the ensuing year: president, Professor Joseph Lovering; vice-president, Dr. Oliver Wendell Holmes; corresponding secretary, Professor Josiah P. Cooke; recording secretary, Professor John Trowbridge; treasurer, H. P. Kidder; librarian, S. H. Scudder. Four new members were elected: Prof. J. W. Mallet of the University of Virginia, and Dr. Atticus G. Haygood of Oxford, Georgia, as associate fellows; George B. Dixwell of Boston as resident fellow; and Adolph Wurtz of Paris as foreign honorary member.

The list of members of the academy now includes one hundred and ninety-two resident fellows, ninety-two associate fellows, and seventy-two foreign honorary members. The loss by death this year has been as follows. Resident fellows: Augustus A. Hayes, Brookline; William B. Rogers, Chandler Robbins, and Nathaniel Thayer, Boston. Associate fellows: Charles Avery, Clinton, N.Y.; Henry Draper, New York; Isaac Ray, Philadelphia; George P. Marsh, Rome. Foreign honorary members: Joseph Liouville, Paris; Émile Plantamour, Geneva; Friedrich Kohler, Göttingen; T. L. W. Bischoff, Munich.

The academy voted unanimously to confer the Rumford gold medal upon Professor Henry A. Rowland of Baltimore for his researches in light and heat.

The following papers were presented by Mr. W. T. Brigham: 1. Recent volcanic phenomena on the Hawaiian Islands; 2. The flow of lava-streams as illustrated by the Hawaiian eruption of 1881. Professor Cooke presented the following contributions from the chemical laboratory of Harvard university by title: 1. On tumerol, by C. Loring Jackson and A. E. Menke; 2. On curcumin, by the same authors; 3. On the action of phosphorous trichloride of aniline, by the same authors; 4. On the action of sodic ethylate on benzaldehyde, by C. Loring Jackson and G. T. Hartshorn; 5. On the action of concentrated hydrobromic acid upon mucobromic acid and other related substances, by H. B. Hill; 6. On the action of alkaline hydrates upon mucobromic acid, by H. B. Hill and E. K. Sterns; 7. On phenoxychloracrylic acid, by M. Loeb; 8. On β-phenyltribrompropionic acid, by L. P. Kinnicutt and G. M. Palmer; 9. On the determination of nitrites with potassic permanganate, by L. P. Kinnicutt and J. U. Nef; 10. On the determination of sulphites with potassic permanganate, by L. P. Kinnicutt and R. Penrose; 11. On the vapor density of the chloride, bromide, and iodide of antimony, by C. P. Worcester; 12. On a method of correcting the weight of bodies of unknown volume for the buoyancy of the atmosphere, and its applications, by J. P. Cooke. Professor Asa Gray presented the following from the Botanic garden. Contributions to American botany: 1. List of plants from south-western Texas and northern Mexico, collected chiefly by Dr. E. Palmer in 1879–80 (II. Gamopetalae to Acotyledones) by Sereno Watson; 2. Descriptions of new species of plants, with revision of certain genera, by Sereno Watson. Professor Trowbridge presented the following papers from the physical laboratory of Harvard university: 1. Attraction of a shell bounded by confocal ellipsoidal surface, by F. N. Cole; 2. Weber's theory of magnetism, John Trowbridge and C. B. Penrose; 3. Electromotive force, John Trowbridge and E. K. Stevens; 4. Effect of magnetism on the conduction of heat, John Trowbridge and C. B. Penrose. A paper on the deduction of different star catalogues to a common system was presented by title by Prof. W. A. Rogers.

— At the semi-annual meeting of the American oriental society, held in the hall of the American academy, Boston, May 2, papers were read as follows: by T. O. Paine, on the Julian inscription of Gerash; by L. Dickerman, on the Site of the Pithom of Exodus i. 11; by B. S. Lyman, on the Japanese Nigori of composition; by J. W. Jenks, Some remarks on oriental genius; by W. D. Whitney, on the Jāiminīya Brāhmana; by J. Avery, on the Modes in relative clauses in the Rig-Veda; by M. Bloomfield, on Certain Vedic subjunctive forms; by D. G. Lyon, Discussion of the question whether or not there was a god El at the head of the Babylonian pantheon; by I. H. Hall, on the Bronze crab inscription on the New-York obelisk; by B. S. Lyman, on Certain Pekingese sounds; and by W. W. Rockhill, Translation of two Buddhist Sūtras. The society adjourned to meet in New Haven in October.

— M. Raoul Pictet has recently completed a small steam-vessel designed to illustrate the advantages possessed by a form of hull proposed by him to be adopted for very high speeds, and has made preliminary trials on the waters of Lake Geneva. His boat has a full, nearly square, midship section, with a flat floor and sharply turned bilges, vertical topsides, a sheer plan having a line of keel very nearly parabolic, the vertex of the curve at the bow, and the maximum ordinate at the rudder-post. The leading idea is to so form the vessel that the water shall be displaced vertically downward as far as possible, in order that the

upward reaction shall raise the craft, and thus diminish head-resistance at very high speeds.

Comparing the curve of resistance with that of boats of the usual form, it is found that it does not differ, in any great degree, at ordinary low speeds; but at sixteen kilometres and upward (about ten miles) the resistance is less, and at twenty-seven kilometres (sixteen and three-fourths miles) the resistance is but about one-half that of the common form of vessel. The Pictet boat was tested beside the fast yacht of Madame Rothschild, the Gitana, and was found to be slightly inferior at low speeds, but decidedly superior at the higher speeds.

The new vessel is of a little more than twenty-five tons' displacement. It would seem that the proposed form would be of less importance for large vessels, in which the resistance is in larger proportion frictional, and less in head-resistance, and that the advantages of the Pictet form are to be realized principally in small yachts and in torpedo vessels. The boat and its performance are described in *La Nature*, and reproduced in the *Sc. Amer. supplement*, May 19, 1883.

— At the meeting of the Biological society of Washington, May 25, the following papers were read: Dr. Thomas Taylor, on Actinomykosis, a new infectious disease of man and the lower animals, with exhibition of a portion of the diseased viscera of a dog, containing specimens of the fungus Actinomyces; Dr. D. E. Salmon, remarks on Actinomykosis; Prof. C. V. Riley, remarks on curious Psyllidae and certain gall-making species.

— Mr. Lester F. Ward has made a preliminary study of an interesting collection of fossil plants brought to the U. S. geological survey in 1882, by Dr. C. A. White, from the Laramie beds of the lower Yellowstone River. No less than thirty-four species are identified with those already described and figured, including many of those from Fort Union, described by Dr. Newberry, and a number from other localities in the west. A few, however, belong to species that have not heretofore been found within the territory of the United States (arctic or European). In addition to these, there was found a large number of forms which could not be identified, some of which are of peculiar interest. As Mr. Ward expects to visit these beds during the present season, and hopes to obtain more and better material, no descriptions of new species will be published until further study of these forms can be made.

— Ten years ago the magnificent private collections of Dr. Gustav Klemm, whom all anthropologists love to honor, were sold by his heirs to the city of Leipzig for the Museum für völkerkunde. If we mistake not, Dr. Klemm was the first to announce distinctly the oneness of all human art and industry as a unique subject of study, dividing human occupations, implements, processes, and productions into genera and species, and aiming to find in each class the cause of its origin, as well as the law of its evolution. Each year since the transfer, a report of the progress of the museum has been published, the tenth number of which has just come to hand. The affairs of the institution are managed by a board of trustees, who rely upon subscriptions mainly to pay the current expenses.

— The explorers whom the French geographic society has recently adjudged worthy of its gold medals are: Commandant Gallieni, for his expedition to the upper Niger and Segu two years ago; Commandant Derrien, leader of a topographic party in Senegal at the same date; M. Charles Huber, for travels in Arabia during the past three years; Lieut. F. Schwatka, for his arctic voyage to King William's Land; and M. Langlois, for maps of the department of Oran, Algeria.

— At the meeting of the Engineers' club of Philadelphia, May 5, Mr. T. M. Cleemann was enabled to show, through the courtesy of Mr. W. W. Evans of New York, a map and profile of the Southern Pacific railroad in California, where it crosses the dried-up bed of a lake, being below the surface of the Pacific Ocean for 58 miles, and attaining a depth below said surface of 266 feet. At this point it skirts a deposit of salt from six to twenty-four inches in thickness. He also showed a number of photographs of the Tehachapi Pass, on the same railroad, near San Fernando. In order to attain the summit with a sufficiently reduced grade, the line was 'developed,' advantage being taken of a conical hill to wind about it in the form of a helix, crossing itself, and continuing on its way with several meanderings. The St. Gothard railroad has several such helices, but they are cut in the solid rock. A similar location was made, about eighteen years ago, on the Southern Pennsylvania railroad, but it was not built. Another piece of interesting location was also exhibited; namely, the mountain division of the Western North Carolina railroad, which shows great skill in fitting a line to the country. Mr. George S. Strong described a new method of manufacture of corrugated boiler-tubes. Mr. E. F. Loiseau gave a sketch of the progress and condition of the manufacture of artificial fuels. Mr. R. H. Sanders described a derrick used for hoisting material from a slate quarry by means of cable and bucket; and Mr. T. M. Cleemann noted a similar method pursued in the construction of a viaduct in Peru, 252 feet high, when the pieces were conveyed by a traveller to the pier. Mr. C. G. Darrach continued his remarks with regard to the relative quality of water at the top and bottom of deep reservoirs, and discussed methods of meeting the difficulty encountered in the accumulation of impurities below the surface.

— C. F. Holder contributes to the June number of Lippincott's magazine an excellent article on Animals extinct within human memory. The greater portion

of the paper relates to birds, — the great auk, the dodo, and the giant birds of New Zealand ; but the mammoth and Steller's manatee are specially mentioned among mammals.

— The Royal geographical society has lately awarded medals to Sir J. D. Hooker for his services in scientific and botanical geography, extending over many years, and based on voyages to the Antarctic and Australian seas, to India and the Himalaya, and travels in Morocco and the United States ; and to E. C. Baber, of the British legation at Peking, for his reports and maps of journeys into the interior of China. Money-grants were voted to Abbé Petitot for his researches to the north of Great Slave Lake, to W. D. Cowan for his surveys in central Madagascar, and to F. C. Selous for his journeys in the Zambesi basin.

— At a meeting of the Society of arts, Massachusetts institute of technology, May 24, Professor Elihu Thomson exhibited in operation, and explained, the Thomson-Houston system of electric lighting of the American electric company of New Britain, Conn.

— When noticing, in a former number of Science, the curious worm-like articulated impressions from the Potsdam sandstone, the writer of the notice was not aware that the name 'Rusichnites' had been previously proposed by Mr. Whiteaves for the similar markings from the Gaspé sandstone referred to in the note.

— In the weekly summary, ¶ 614, for 'tortricid moth,' read 'tineid moth.'

RECENT BOOKS AND PAMPHLETS.

Adamson, Ch. M. Another book of scraps, principally relating to natural history. Newcastle-on-Tyne, 1883. illustr. 4°.

Aschieri, F. Geometria projettiva e descrittiva. Milan, 1882. 354 p. 12°.

Beddome, R. H. Handbook to the ferns of British India, Ceylon, and the Malay Peninsula. London, *Thacker*, 1883. 500 p., 300 illustr. 8°.

Bove, G. Patagonia, Terre del Fuoco, Mari Australi. Rapporto della spedizione da lui capitanata al Comitato centrale per le esplorazioni antartiche. Part I. Genoa, *R. Istituto*, 1883. 150 p. 8°.

Brown, J. C. The forests of England, and the management of them in by-gone times. Edinburgh, 1883. 268 p. 8°.

Busley, C. Die schiffsmaschine, ihre construction, wirkungsweise u. bedienung. Abtheil. i. Kiel, 1883. 240 p. 8°.

Chalon, J. Les premiers âges de la terre et de l'homme fossile. Bruxelles, 1883. 105 p., illustr. 12°.

Clerk, Ch. Études de géologie militaire. Les Alpes françaises. Paris, 1883. illustr. 8°.

Comisión del mapa geológico. — Breve idea de la constitución geológica de España, presentada en la exposición de mineria, celebrata en Madrid en 1883. Madrid, *Tello*, 1883. 20 p. 8°.

Crié, L. Essai sur la flore primordiale. Paris, 1883. 80 p., illustr. 8°.

Devic, L. M. Le pays des Zendjs, ou la côte orientale d'Afrique au moyen âge (géographie, moeurs, productions, animaux légendaires), d'après les écrivains arabes. Paris, *Hachette*, 1883. 280 p. 8°.

Eckardt, T. Physics in pictures: the principal natural phenomena and appliances described and illustrated. Translated by A. H. Keane. London, 1883. illustr. f°.

Fick, A. Philosophischer versuch über die wahrscheinlichkeiten. Würzburg, 1883. 8°.

Fischer, E. L. Ueber das princip der organisation u. die pflanzenseele. Mainz, 1883. 153 p. 8°.

Garrod, A. E. The nebulae: a fragment of astronomical history. London, *Parker*, 1883. 44 p. 8°.

Gaudry, A. Les enchainements du monde animal dans les temps géologiques fossiles primaires. Paris, *Savy*, 1883. 323 p., 285 illustr. 8°.

Gisevius, P. Beiträge z. methode d. bestimmung d. spec. gewichts v. mineralien u. d. mechan. trennung von mineralgemengen. Bonn, 1883. 81 p. 8°.

Goodwin (bishop of Carlisle). Walks in the regions of science and faith. London, *Murray*, 1883. 304 p. 8°.

Guillemin, A. Le monde physique. Paris, *Hachette*, 1883. 3 vols. 32+874; 4+670; 1011 p., illustr. 8°.

Haussknecht, O. Lehrbuch der chemie u. chemischen technologie. Hamburg, 1883. 484 p., illustr. 8°.

Hirsch. Rapport sur les machines et les appareils de la mécanique générale à l'Exposition universelle internationale de 1878 à Paris. Paris, 1883. 609 p. 8°.

Hollefreund, K. Die gesetze der lichtbewegung in doppelt brechenden medien nach der Lommel'schen reibungstheorie. Halle, 1883. 4°.

Houba, M. J. H. Over de strooming van vloeistoffen door buizen. Nijmegen, 1883. 104 p. 8°.

Hoyer, A. G. E. Planten-album. Ter bevordering van de kennis der algemeen in Nederland groeiende planten. Tiel, 1883. 95 p. 4°.

Kolbe, H. Kurzes lehrbuch der organischen chemie. Braunschweig, 1883. 509–864 p. illustr. 8°.

Lanier, L. Choix de lectures de géographie, accompagnées de résumés, d'analyses et de notes explicatives. Paris, *Belin*, 1883. 8+656 p. 12°.

Le Paige, M. C. Essai de géométrie supérieure du 3e ordre. Bruxelles, 1883. 132 p. 8°.

Lindner, M. Die elektricität im dienste v. gewerbe u. industrie. Leipzig, 1883. 4°.

Maurer, M. Statique graphique. Paris, 1883. illustr. 8°.

Melde, F. Akustik. Fundamentalerscheinungen u. gesetze einfach tönender körper. Leipzig, 1883. 364 p. illustr. 8°.

Naville, E. La physique moderne. Paris, 1883. 8°.

Nysom, H. Hydrografisk kart over det sydlige Norge udarbeidet ved kanalkontoret. Christiania, 1882. 8°.

Ormerod, E. A. Report of observations of injurious insects during the year 1882; with methods of prevention and remedy, and special report on wireworm. London, *Simpkin*, 1883. 98 p. 8°.

Pattison, S. R., and **Friedrich**, Dr. The age and origin of man geologically considered. London, *Religious tract society*, 1883. 53 p. 12°.

Paulucci, M. Note malacologiche sulla fauna terrestre e fluviale dell'Isola di Sardegna. Siena, 1882. 247 p. 8°.

Pellet, H., and **Seugier**, G. La fabrication du sucre. T. i.: Historique; les principes sucrés; saccharimétrie chimique et physique; analyse des sols; les terres à betteraves. Paris, *Pellet*, 1883. 390 p., illustr. 8°.

Rieth. Volumetrische analyse. Hamburg, 1883. 8°.

Saarbrucker steinkohlen-district. Flötzkarte. Mit profilkarte. Aubeldruck, *Saarbrücken*, 1883. f°.

Salterain, Pedro. Breve reseña de la mineria de la isla de Cuba. Habana, *La Publicidad*, 1883. 24 p. 8°.

Schaedler, C. Die technologie der fette u. oele des thier- und pflanzenreichs. Berlin, 1883. illustr. 8°.

Schwartze, Th. Telephon, mikrophon u. radiophon. Wien, 1883. illustr. 240 p. 8°.

Sicard, G. Histoire naturelle des champignons comestibles et vénéneux. Préface par A. Chatin. Paris, 1883. illustr. f°.

Songaylo, E. Traité de géométrie descriptive. Paris, 1883. 6+440 p., illustr. 4°.

Tissandier, G. Le problème de la direction des aérostats. Paris, 1883. 8°.

Travaux publics de la France. Publié sous les auspices du ministère des travaux publics, et sous la dir. de L. Reynaud. Paris, 1883. illustr. f°.

Tribolet, M. de. La géologie, son objet, son développement, sa méthode, ses applications. Conférence académique. Neuchâtel, 1883. 49 p. 8°.

Ullrich, V. Die horizontale gestalt u. beschaffenheit Europas u. Nordamerikas. Beitrag zur morphologie beider erdräume. Leipzig, 1883. 8°.

Urban, J. Monographie der familie der Turneraceen. Berlin, 1883. 152 p., illustr. 8°.

Witz, A. Histoire des moteurs à gaz. Paris, 1883. 8.

SCIENCE:

AN ILLUSTRATED WEEKLY

OWNED BY THE SCIENCE COMPANY.

DIRECTORS.

D. C. GILMAN . . . . . . PRESIDENT,
President Johns Hopkins University.

A. GRAHAM BELL . . VICE-PRESIDENT,
Inventor of the Telephone.

GARDINER G. HUBBARD,
Attorney and Capitalist.

OTHNIEL C. MARSH,
President National Academy of Sciences.

SAMUEL H. SCUDDER,
President Boston Society of Natural History.

TERMS.

SUBSCRIPTIONS.—$5 a year in United States and Canada; $6 a year in all other countries.

SINGLE COPIES.—15 cents each.

ADVERTISEMENTS.—$60 a page, each insertion; parts of pages in proportion.

CIRCULATION.—Never less than 6,000 copies a week; oftentimes ranging from 6,000 to 10,000 a week.

PUBLICATION DAY.—"Science" is published every Friday. To insure insertion in current week, all matter must reach Cambridge on Monday morning.

CORRESPONDENCE.—Address all communications relating to contents of the paper proper to "Editor of 'Science,' 19 Brattle Street, Cambridge, Mass.," and all business correspondence to the undersigned.

MOSES KING, *Publisher,*
P. O. Box 24. CAMBRIDGE, MASS.

SCIENCE DIRECTORY
OF

'rustworthy firms dealing in or manufacturing apparatus, books, and other goods required by persons ngaged in scientific and literary work.

The publisher has carefully made up this directory, and inserts the name of no firm that he has ny reason to believe is not wholly trustworthy in every articular. Any subscriber or reader of "Science" whoever experiences any difficulty with one of these rms will greatly oblige the publisher by notifying im of the fact, so that the firm's name may immeiately be taken from this Directory.

It may be taken for granted that any firm herein mentioned will promptly and carefully send all desired nformation — with catalogue and circulars, whenever ssued — to any person who mentions this paper n pening the correspondence.

MOSES KING, Publisher of "Science,"
CAMBRIDGE, MASS.

Albertypes and Lithographing.
'ORBES COMPANY, 181 Devonshire St., Boston.

Amateur Photograph Outfits.
3LAIR TOUROGRAPH Co., 471-475 Tremont St., Boston.

Electrical Supplies and Test Instruments.
ELECTRICAL SUPPLY Co., 17 Dey St., New York.

Illustrations and Drawings.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

Photo-Engraving and Designing.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

RECENTLY PUBLISHED.

STUDIES IN LOGIC.

By Members of the Johns Hopkins University

12mo. Cloth, $2.00.

LITTLE, BROWN, & CO.,
PUBLISHERS,
254 Washington Street, Boston.

THE NATION.

EIGHTEENTH YEAR.
Size recently enlarged to twenty four pages, and PRICE REDUCED TO $3 PER YEAR.
Sample copies sent on request. Address the PUBLISHER, 210 BROADWAY, NEW YORK.

THE NEW BOTANY.
A lecture on the best method of teaching the science. By W. J. BEAL, M. Sc., Ph. D., Professor of Botany in Agricultural College, Lansing, Mich. Second edition. 8vo, paper. Mailed, postage free, for 25 cents. Send for circular and book list free. Address,
CHARLES H. MAROT, PUBLISHER,
814 Chestnut Street, Philadelphia.

CUSHING'S MANUAL OF PARLIAMENtary Practice. The recognized authority in all the States on rules and order of debate, and is an indispensable handbook for every citizen. Price, 75 cents. Sent by mail on receipt of price.
THOMPSON, BROWN, & Co., Publishers,
25 Hawley Street, Boston, Mass.

WEBSTER

ALL 32,000 copies in Public Schools. Sale 20 to 1 of any other series.
BEST aid to make a Family intelligent. Best help for SCHOLARS, TEACHERS and SCHOOLS.
It is the best practical English Dictionary extant.—*London Quarterly Review.*

"It has all along kept a leading place, and the new edition brings it fairly up to date."—*London Times, June,* 1882.

"It has come to be recognized as the most useful existing 'word-book' of the English language all over the world."—*N. Y. Tribune,* 1882.

☞The Vocabulary contains 3,000 more words than are treated in any other American dictionary.

G. & C. MERRIAM & CO., Pub'rs, Springfield, Mass.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.
Engraver on Wood. References · American Steam Gauge Co., Boston Journal of Commerce.

ELLIOTT BROS., LONDON.

Electrical Test Instruments,

From stock or imported to order.

Voltmeters and Ammeters,

From stock or manufactured and imported to order.

THE ELECTRICAL SUPPLY CO.,

17 Dey Street, New York.

TOOLS AND MATERIALS of all kinds for Experimenters and Amateurs.
Illustrated Catalogue free to any address.
GOODNOW & WIGHTMAN,
176 Washington St., Boston, Mass.

A USEFUL BOOK.
For the benefit of ladies who use knitting silk, the Nonotuck Silk Company have carefully prepared a book entitled "How to use Knitting-Silk." It is full of new engravings, and handsomely printed. Sent on receipt of three two-cent stamps.
NONOTUCK SILK Co., Florence, Mass.

COLUMBIA BICYCLES.

DAKOTA.
Trustworthy information given and safe and lucrative investments made for non-residents in this most prosperous region.
NEW YORK REFERENCES.—Horace White; George S. Morrison. BOSTON REFERENCES.—Tower, Giddings & Co.; Henry F. Coe. SALEM REFERENCE.—David Pingree.
ALDEN & WATERS, Land Agents,
JAMESTOWN, DAKOTA.
John A. Alden. Clifford C. Waters.

THE BRADSTREET COMPANY'S

BINDING DEPARTMENT.

This department having been recently re-organized, we are now prepared to execute orders for

EVERY DESCRIPTION OF

BINDING IN LEATHER,

From the ordinary periodical to the finest work in

VELLUM, LEVANT, MOROCCO, CALF AND RUSSIA,

WITH ELABORATE HAND-TOOLING.

THE ATTENTION OF PRIVATE ILLUSTRATORS IS ESPECIALLY INVITED.

THE BRADSTREET COMPANY,

CHARLES F. CLARK, PRESIDENT.

Nos. 279, 281 and 283 Broadway, · · · New York.

Students' Songs.

A new collection of songs, as sung by jolly students at all leading colleges throughout this country, has just been published, under the title of "STUDENTS' SONGS," by

MOSES KING,

Cambridge, Mass.

It contains 64 pages of songs, with full piano accompaniments, and sells at only 50 cents a copy.

SCIENCE appears every Friday. Volumes begin in July and January. To insure public[...] must reach Cambridge on Monday. Terms, $5.00 a year in United States an[...] countries. Single copies, 15 cents. Advertising rates sent on request. Ad[...] contents of paper to "EDITOR OF SCIENCE, Cambridge, Mass.," and all business correspondence to MOSES KING[...]

Contents of this Number.

FOOD PRESERVATION.

To the Medical Profession:

We desire to call the attention of the medical profession to a practical and successful Food Preservative, which has been perfected by Prof. R. F. Humiston, of Boston, and called REX MAGNUS or The Human Food Preservative. This is perhaps a fanciful and high sounding title, but it is not inappropriate. It is, indeed, a "Mighty King," for it conquers TIME.

REX MAGNUS *does absolutely preserve* meat, game, poultry, fish, milk, cream, butter, eggs, vegetable juices and food extracts in their natural state, in all seasons and climates, perfectly fresh and sweet, and for any reasonable time, while at the same time it ripens and makes meats better.

Solid Scientific Testimony.

Prof. Samuel W. Johnson, the well-known chemist, and for more than 25 years identified with the Scientific Department of Yale College furnishes the following report concerning Rex Magnus.—

"My tests of 35 days in daily mean temperature of 70°, on meats, &c., bought in open market, have certainly been severe, and I am satisfied that the different brands of Rex Magnus, The Humiston Food Preservative, with which I have experimented, *have accomplished all claimed for them.* So far as I have yet learned, *they are the*

ONLY PREPARATIONS THAT ARE EFFECTIVE,

and at the same time practicable, for domestic use. At the banquet on 'treated' meats at the New Haven House *I could not distinguish between those which had been sixteen days in my laboratory and those newly taken from the refrigerator of the hotel.* The oysters were perfectly palatable and fresh to my taste, and better, as it happened, than those served at the same time, which were recently taken from the shell. The roast beef, steak, chicken, turkey and quail, *were all as good as I have ever eaten.*"

Rex Magnus is *safe, tasteless, pure*, and Prof. Johnson adds in his report "I should anticipate *no ill results* from its use, and consider it *no more harmful than common salt.*"

Invisible Agents of Disease.

It is well known to the medical profession, and to scientists generally, that there exists in the air myriads of reproductive organisms, representing the lowest forms of vegetable and animal life. They are abundant at all seasons, but more especially during the hottest part of the year. These sporules and germs, as algae, fungi, torulae, bacteria, vibrios, etc., though invisible to the naked eye, are now recognized as not only the great cause of fermentative changes, putrefaction and decay, but they are also regarded as the prolific source of many of the inflammatory and purulent diseases. The "septic" or putrefactive changes in animal and vegetable matter, are principally due to these invisible agents, which precede and accompany chemical action.

So Simple a Child can Use.

REX MAGNUS is a simple and harmless combination of antiseptics, and performs its work by destroying or holding in check these minute organisms. It is perfect in construction and always successful in use when applied according to the directions, which are so simple that a child can follow them. It is compounded on strictly scientific principles from pure and harmless ingredients, directly with a view to the uses for which it is intended.

How to Get It.

The proprietors of this great discovery are desirous that it should be thoroughly investigated by the medical profession and scientific men generally throughout the country, and will send a sample pound free to every physician and scientist who will agree to test it. It is the production of a practical scientific man, who has prosecuted his work in a scientific manner, and the successful outcome of his labors will be understood and appreciated by men of science everywhere.

It is a great auxiliary of Health. Composed as it is of perfectly pure ingredients, it will not injure the most delicate system, and by counteracting the principles of decay and putrefaction it renders the food wholesome and healthful. It is, therefore, a great boon to invalids, not only for this reason, but because it also

Destroys Any Hidden Germs

of disease and averts the dangers which would arise from their being taken into the weak and enfeebled system.

There have been at different times several worthless mixtures offered to the public, which have pretended to accomplish this great result, but they have signally failed. This is probably because their projectors have tried to preserve everything with one compound. A really scientific man would know better than this.

Different Brands Necessary.

The various kinds of food differ in their nature, character and component parts, and for their sure and safe preservation different antiseptics are required. Prof. Humiston has kept this point in view, and for the various classes of food the company makes nine different preparations or brands of REX MAGNUS. They do not claim that what is designed for one thing will preserve another, nor do they claim for any of their preparations any more than they will perform.

Medical Endorsement.

It receives the unqualified endorsement of medical men of all schools wherever it has been brought to their notice. As a sample we append the remarks of three physicians who were present at the banquet above referred to.

"I particularly endeavored to detect the taste of any foreign substance," said Dr. C. A. Linsley, Dean of the Medical Department of Yale College, and Health Officer of New Haven, "but could not do so. I know of no other agent that will do what REX MAGNUS has done, i. e., save meats and still be harmless and tasteless. I thought I could detect the treated chicken, *but I was mistaken.*"

Dr. E. A. Winchell, a distinguished physician of New Haven, and also a member of the Board of Health, said "I could detect nothing objectionable, and the meats served at the New Haven House dinner were excellent. Oysters which I ate later, that had been preserved by REX MAGNUS twenty-eight days, were simply luscious. It is a remarkably successful and useful combination."

Dr. B. H. Cheney (homœopathist), a member of the Board of Health, remarked, "I was both surprised and delighted. The beef was excellent, and I couldn't tell it from any other beef; nor could I taste the preservative in it or any of the meats."

Names and Prices.

The various brands and their retail prices are as follows "Viandine," for preserving meats, poultry, fish and game, 50 cents per lb. "Ocean Wave," for oysters, clams, lobsters, fish, &c., 60 cents per lb. "Pearl," for cream, $1.00 per lb. "Snow Flake," for milk, butter and cheese, 50 cents per lb. "Queen," for eggs, $1.00 per lb. "Aqua-Vitæ," for medical purposes and for keeping fluid extracts, $1.00 per lb. "Anti-Ferment," "Anti-Mold" and "Anti-Fly," 50 cts. each.

THE HUMISTON FOOD PRESERVING CO., ... 72 Kilby Street, Boston, Mass.

FRIDAY, JUNE 22, 1883.

THE ROYAL SOCIETY OF CANADA.

THE Royal society of Canada held its second annual meeting in the Parliament house at Ottawa on May 22–25, under the presidency of Dr. J. W. Dawson. This society was organized, as our readers may know, a year since, under the auspices of the governor-general of Canada, the Marquess of Lorne, and includes four academies or sections, each with twenty members and a sectional president or chairman. These sections are as follows: I. French literature, history, etc.; II. English literature, history, etc.; III. Mathematical, physical, and chemical sciences; IV. Geological and biological sciences. Their presiding officers for the past year were respectively, J. M. Lemoine, Daniel Wilson, T. Sterry Hunt, and A. R. C. Selwyn; the general officers of the society being, J. W. Dawson, president; P. J. O. Chauveau, vice-president; J. G. Bourinot, honorary secretary; and J. R. Grant, honorary treasurer.

There was a good attendance, about two-thirds of the members being present, besides which were numerous delegates from various local literary and scientific societies throughout the Dominion. These, by the rules of the Royal society, are entitled to appoint each year a delegate to attend the annual meeting, and present a report of their work and progress. In addition to these, various foreign societies were invited to send delegates; in response to which, Dr. T. Sterry Hunt had been charged to represent the National academy of sciences, and Professor Alpheus Hyatt came in behalf of the American academy of Boston. The Institut of France had appointed Mr. Xavier Marmier, of the Academie française, their delegate; and the French government had offered to send him at the expense of the state, but sudden illness prevented his presence.

After organizing in general session on Tuesday, the society at once divided into its four sections, and proceeded to the reading and discussion of papers, to which were devoted the first two days, with the exception of Wednesday morning. This was set apart for the public exercises of the whole society, which then assembled in the Senate chamber of the Parliament house, the Marquess of Lorne and the Princess Louise being present. The Marquess, to whose zeal for the advancement of letters and science the inception of the society is due, made an address of welcome, congratulating the society on the success which had attended its first year's work. He informed them that the Queen had been graciously pleased to accord to it the title of the Royal society of Canada; that Parliament had granted it an act of incorporation, and, moreover, voted an annual sum of five thousand dollars for the publication of its proceedings and transactions.

No. 20. — 1883.

After pointing out the examples of munificence shown in the encouragement of science by the federal and state governments of the United States, he gave much advice as to the future conduct of the new society, all of which was characterized by the eminent good sense and practical wisdom which distinguishes him. He urged the members of the society to sink all sectional differences and distinctions of province, creed, or race, and aim only at a higher standard of excellence in letters and in science.

Dr. J. W. Dawson then gave his address as president. After a review of the work already done in letters and science in the Dominion, he spoke of the desirableness of a great national museum at Ottawa, and then proceeded to speak in eloquent words of the mutual relations of letters and science. We take the following extract from a report in the *Montreal gazette* of principal Dawson's speech: —

"In conclusion, he referred to the connection of science with literature. The two departments were in this society intimately associated, the literary sections being in some sense scientific as well. Science has a literature of its own, great and increasing, which competes with history and fiction for the popular eye and ear. Nature, rather than art, is the foundation of the best literature. It is on this, rather than on the graces of composition, or the tricks of style, or the flowers of imagination, that enduring literary fame must be built. This is especially the case in a country where history has been and will be marked out by its physical features and resources, and where our real poetry is that of our great rivers

and vast lakes, our boundless plains, our forest solitudes and changeful climate. These are unwritten poems, which have impressed themselves on the minds of our people more than any thing man has yet said or done; and he who most truly interprets them will build up the most lasting fame. For this reason he rejoiced that the society embraced both literature and science; and he was profoundly convinced, that it was for the highest interest of Canada, that, while its scientific men should be men of culture, its literary men should be men of scientific knowledge and scientific habits of thought."

Dr. Chauveau, the vice-president, followed in a brief discourse in French on the progress of both French and English letters in Canada, after which Mr. Louis Frechette, the well-known poet and laureate of the French Academy, recited with much grace and feeling a poem on The discovery of the Mississippi.

On Thursday, the Queen's birthday, the morning was given to a business-meeting of the society, after which the members and delegates were entertained at lunch by the governor-general at Rideau Hall, and were subsequently received by the princess at a garden party. Friday morning was devoted to receiving reports, the election of officers, and other business. In sections I. and III., Messrs. Louis Frechette and J. B. Cherriman were chosen chairmen in place of J. M. Lemoine and T. Sterry Hunt. Dr. Dawson, the president, having declined re-election, Dr. P. J. O. Chauveau, the vice-president, was elected in his place as president of the society, and Dr. T. Sterry Hunt as vice-president, for the ensuing year.

IT would be foreign to our purpose to give an account of the communications on literary and historical subjects which were presented to the first and second sections of the society during the meeting. One of these, however, which, on account of its especial interest to the society at large, was by request read in general session, deserves notice. This was a paper by Dr. Alpheus Todd, librarian of Parliament, on the relation of the new royal society, and of similar societies, to the state, and was replete with valuable information and suggestions. He sketched the history of the Royal society of arts of Jamaica, which is there doing an important work, and then gave an account of the Royal society of New South Wales, a colony which has already made great advances in all matters relating to intellectual progress. That country, we were informed, now numbers about a hundred literary and scientific societies, or 'one to every one hundred and fifty adult males of the population.' A government astronomical observatory, a geological survey, a botanic garden, a gallery of fine arts, and a free public library, the latter under the direction of the minister of public instruction, are among the evidences of the enlightened educational policy of this colony; and to crown the whole we have the Royal society of New South Wales, which aspires to lead the scientific movement of the country, and to give aid and direction to all its various scientific and literary institutions.

Dr. Todd then proceeded to review the history of the Royal society of London with especial reference to its present important position in relation to the state. This body, which has, moreover, considerable revenue of its own, has now for more than a third of a century received from the imperial government an annual grant of one thousand pounds, to be employed in aid of scientific research at the discretion of the president and council of the society, — an amount which, since 1876, has been augmented to from four to five thousand pounds annually, without counting special grants for astronomical and other investigations conducted under the auspices of the Royal society. To it was intrusted the organization of the Challenger expedition. The Weather bureau, moreover, with its annual expenditure of fifteen thousand pounds, originally under the Board of trade, is now conducted by a commission appointed by the crown on the nomination of the president and council of the Royal society. This disposition of the British government to place the scientific work of the nation under the control of its Royal society is an example already imitated by New South Wales, and one which will, it is hoped, be followed by the government of the New Dominion. Dr. Todd did not allude to the National academy of sciences of the United States, one object in the creation of which was the establishment of a body to serve as scientific aids and councillors to the federal government, — a function which they have efficiently discharged on many occasions with vast advantage to the state. The United States Congress has, however, thus far in its relations to the National academy, failed to imitate the wise generosity of the British parliament, or even that of the Dominion parliament to its newly formed Royal society.

Among the papers in section III. may be mentioned one by Professor McGregor of Halifax, on the variation of the polarization of electrodes with their difference of potential; one by Professor Dupuis of Kingston, on the construction of a sidereal clock to show mean time; and one by Capt. Deville of Ottawa, on the measurement of terrestrial distances by astronomical observations, in which he proposes to employ the difference of azimuths instead of the difference of latitudes. Mr. Baillargé of Quebec contributed papers on some problems in hydrographic surveying, and on suggestions for a new edition of Euclid.

Dr. Harrington of Montreal gave a description, with analyses, of two rare minerals now found for the first time in Canada, — meneghinnite and tennantite; and Dr. Ellis of Toronto described telluric gold-ores found on Lake Superior, exhibiting tellurium extracted therefrom; he also gave an analysis of a remarkable sulphur-water found near Port Stanley, Ontario, and described certain applications of Löwenthal's method for the determination of tannin. This was followed by an account, by Mr. Thomas Macfarlane of Montreal, of certain unexpected reactions attending the decomposition of sodium sulphate by carbon.

In the second day's session, Mr. Sandford Fleming discussed the question of a universal meridian for the regulation of time; after which, reports were presented of the observations made, at various points throughout the dominion, of the late transit of Venus, successful observations being reported from Cobourg, Ottawa, Kingston, and Winnipeg.

Professor Haanel of Cobourg described at length his ingenious mode of blowpipe-testing by means of hydriodic acid, and subsequently, in an evening session, gave experimental demonstrations of its application. His process depends upon the conversion of the various metals into volatile iodides, which are condensed on plates of plaster of Paris, and, by their different colors and subsequent behavior, are found to afford ready means of identifying and distinguishing, at a single operation in many cases, several elements in a mineral compound. Mr. Gisborne read a paper giving an account of recent progress in telegraphy, and Mr. Macfarlane described some interesting phenomena of double decomposition presented in the reaction between sodium chloride and zinc sulphate. This was followed by a paper by Dr. T. Sterry Hunt on the mechanical transfer of matter in the process of segregation, as shown in mineral masses, — a phenomenon which, in the discussion following, was shown by Mr. Thomas Macfarlane to be well illustrated in the concentration which occurs in the process of kernel-roasting of cupriferous pyrites.

In section IV., Dr. Selwyn of the Geological survey of Canada read a paper on some features in the geology of Lake Superior, most of the points of which have lately been discussed by himself and others in the pages of SCIENCE. At a subsequent meeting a discussion of this paper took place, Messrs. Bell, Macfarlane, Sterry Hunt, and J. W. Dawson taking part therein, and contesting many of the views of the author. Principal Dawson presented a paper on spores and spore-cases from the Erian rocks, of which an abstract will be found in our weekly summary, under Botany. A detailed study of the distribution of the subdivisions of the carboniferous rocks in the maritime provinces was communicated by Mr. E. Gilpin, jun.; and Dr. G. M. Dawson described the triassic rocks of the western parts of the dominion. Dr. Robert Bell gave an account of the soils of the Canadian north-west territory, an abstract of which appears farther on, under Physical geography. An interesting discussion followed the reading of this paper, in which Professor Macoun and Dr. J. W. Dawson took part. Dr. T. Sterry Hunt made a communication entitled 'Studies of serpentine rocks,' in which, after sketching the history of opinions for the past century as to the origin and geognostical relations of serpentine, he proceeded to describe the modes of its occurrence in various parts of Europe and North America, particularly noting the serpentines of Pennsylvania and those of the vicinity of New-York City, including Staten Island. He also presented a memoir on the question of the Taconic system in geology. Prof. L. W. Bailey gave an interesting account of Indian remains found in the province of New Brunswick.

The foregoing list of papers presented to the scientific sections of the society is unavoidably incomplete and imperfect, communications having been made, among others, by Prof. E. J. Chapman of Toronto, and Dr. J. R. Grant and Professor Macoun of Ottawa; to which should be added a paper by Mr. G. F. Matthew of St. John, N.B., in continuation of his studies on the trilobitic fauna of the Cambrian rocks of that locality, with numerous figures. It is understood that the various memoirs presented to the society, both at this meeting and at its first organization a year since, will soon be published in the form of transactions, in quarto, with suitable illustrations, making what we trust will be the first of a long series of Transactions of the Royal society of Canada.

THE INTERNATIONAL FISHERIES EXHIBITION.—SECOND PAPER.

THE International fisheries exhibition has thus far been successful to a degree which astonishes its most sanguine supporters. At least 200,000 people passed through the turnstiles during the first week. This number of visitors represents receipts to the amount of $45,000, in addition to $40,000 or thereabouts from the sale of season-tickets. The official catalogue is said to have cleared $15,000 above its cost, through advertisements, before a single copy had been sold; and the first edition of 25,000 copies is nearly exhausted. The arrangements for lighting the exhibition galleries by the various systems of electrical illumination have not been completed, and the exhibition is now closed at 7 P.M: when it is kept open until 10, the number of visitors will doubtless increase; for, in addition to the legitimate attractions of the exhibition, thousands will be induced to attend by the illuminations and music in the gardens of the Royal horticultural society, in which the exhibition is held. On the opening day, only the court and the holders of season-tickets were admitted. The next public day was Whitsun Monday, one of the half-dozen or more new 'bank holidays' which have recently been bestowed upon the British public by Sir John Lubbock's parliamentary bill. Not less than 45,000 people paid their shillings at the door, and at one time 8,000 entered in a single hour. The attendance on the following days was less; but on Wednesday, when admission-tickets cost half a crown, nearly 12,000 were present. It is evident that the entire liabilities of the executive committee, amounting to fifty or sixty thousand pounds, will be met long before the close of the exhibition in November. It is almost certain that the profits will be applied, as was done after the great exhibition of 1857, to some object of public educational importance. The press is beginning to urge that this shall be the establishment of a National museum of fisheries at South Kensington; and the action of the management of the South Kensington museum seems to indicate that such is their purpose, for they have appointed a committee of four to take charge of the interests of such permanent fishery collections as may grow up as a result of the exhibition. This committee consists of Edward Birkbeck, M.P., honorary general manager of the exhibition, Sir James Maitland, director of the South Kensington museum, Professor Huxley, and Dr. Day; and in its constitution must certainly be satisfactory to the scientific men of England, who are complaining through the columns of *Nature* that this present exhibition differs from its continental predecessors in having been organized without the co-operation, to any very great extent, of the professional zoölogists of the country.

The readers of SCIENCE have already seen in the daily papers descriptions of the events at the opening of the exhibition on the 12th. The entire English court was present; and the gorgeous costumes of the royal family and their households, the picturesque garments of the foreign ambassadors and commissioners, the military and naval officers, the yeomen of the guard, the Queen's watermen, the English, Scotch, and Irish fishermen, the fishiwves from Scotland, Belgium, France, and Holland, mingled with the bright decorations and the striking objects among which they were passing, made the scene very brilliant and impressive. The building devoted to North America contributed its contingent to the ethnological display of the day. Canada had a Melicete Indian in gala dress; the United States, a Carolina negro clad as a whaleman, besides numerous lay-figures of its fishermen in their customary dress, so lifelike in appearance that they were constantly mistaken by visitors for living men.

Science was very inconspicuous in this rainbow-hued pageant; but I noticed in the procession Professor Huxley, in the costume of Inspector of fisheries; Dr. Day, in the uniform of Surgeon-general; Professor Smitt, in that of the Royal Swedish academy of sciences; Professor Honeyman, Commissioner from Nova Scotia, in scholastic dress, with the scarlet cape of Doctor of civil law; and Baron de Solsky, Director of the St. Petersburg museum, his breast ablaze with decorations. The most imposing figure of all was that of Professor Richard Owen, whose venerable form, strong features, and flowing white hair, were brought out in strong relief, against the bright colors around, by his coat and skull-cap of black velvet.

On the evening of the opening day, all the officials and commissioners were entertained at a banquet in Fishmongers' Hall. The most noteworthy events of this occasion were the thoughtful speeches of the Prince of Wales and his brother the Duke of Edinburgh. The former had already tersely demonstrated his appreciation of the objects of the movement by the remark, "The purpose of this exhibition is to illustrate the present and past condition of one of the most ancient, exten-

sive, and important of industries, and to promote that careful collection and discussion of facts by means of which alone we can hope to deal in a satisfactory manner with the many difficult, practical, and scientific problems connected with fish and fisheries." At the banquet he laid especial stress upon the practical results which he hoped might result to the fisheries, and upon the importance of stimulating every possible scientific invention for the saving of life at sea.

The remark made by one of the speakers at the banquet — "that, by consenting to act as president of the exhibition, the Prince of Wales had done more than any man had ever done before for the fisheries of the world" — sounded strangely to an American; but, discounting the courtier element in this speech, the fact remains, that much of the success of the exhibition, and of its consequent possible benefit to Great Britain, is due to the active part which the Prince has taken in its interest.

The newspapers, from *Punch* to the *Times*, be they social, commercial, literary, comic, or scientific in their scope, are full of the exhibition. Many of them announce special numbers, or series of special articles, devoted to its discussion; while at least two periodicals, one an illustrated monthly, are established as its special exponents. The *Times*, which Emerson has told us thinks for all Englishmen, and 'is their understanding and day's ideal daguerrotyped,' gave an entire page on Monday to a description of the opening, and for several days has been printing editorials discussing the subject from various stand-points. It has printed a column article upon the exhibit of the United States, and promises two more special articles. In the first it is remarked, that, in variety and completeness of illustration, the collection from the United States is not surpassed by that of any of the foreign contributors. This verdict is confirmed by most of the editors, and in especially strong terms by *Land and water* and the *Field*, the two fishing-journals; the latter remarking, "The whole American court affords food for study, and, for completeness, is beyond comparison the best in the exhibition, whether as to fishing-vessels or fishing-gear." Especially gratifying is the letter sent to the *Times* by Gen. A. Pitt Rivers, the ethnologist, who draws attention to the fact that this is the only department in the whole exhibition which is arranged historically.

In the Chinese, Japanese, Scandinavian, and Dutch courts there are objects which the scientific student of the arts of life may pick out and arrange in their proper order in his own mind; but in that of the United States, following the method adopted in the National museum at Washington, something more is attempted to bring the department into harmony with modern ideas. "Models showing the development of the art of ship-building have been arranged in sequence; the various contrivances for catching fish have been shown in association with the rude appliances of savages, from which they sprang; and the improvements and varieties of recent times have been placed as far as possible in chronological order. This gives to the exhibition a value which is apart from commerce, and an interest which is beyond the mere requirements of fish-culture; and it may be regarded as one out of the many indications of the way in which the enlightened government of the United States marks its appreciation of the demands of science."

The press is full of plans for the practical outcome of the exhibition. Some of the editors expect to see fish cheaper; some, to see the cheaper kinds of fish coming into general use; some, to see fish of all kinds more generally used; some, to see an immense increase in the yield of the fisheries; some, to see legislation stricter and more strongly enforced. Professor Huxley, when asked what his expectations from the exhibition were, replied that he had none at present beyond a general awakening of interest in fish-culture and the fisheries, from which, in time, some good would certainly result. The conference to be held in June, for the discussion of various questions of practical and scientific interest, will doubtless be one of the most important features of the exhibition. Professor Huxley will deliver the opening address; and the words of wisdom which shall then be uttered must necessarily have much influence in determining what are to be the benefits of this great international convention to Great Britain and to the world at large.

RECENT DEEP-SEA SOUNDINGS OFF THE ATLANTIC COAST OF THE UNITED STATES.[1]

The explorations of the Gulf Stream, instituted by Alexander Dallas Bache, superintendent of the coast-survey, and carried on under his direction between the years 1845 and 1860, though necessarily to a great ex-

[1] Abstract of Appendix no. 19. Coast and geodetic survey report for 1882. Communicated by the superintendent of the U. S. coast and geodetic survey, Washington, May, 1883.

tent tentative in their nature, have furnished results of great interest and value to the navigator, have stimulated later researches, and have led to the adoption of a definite plan, according to which have been made the observations for depth and temperature in the waters of the Gulf of Mexico, the Caribbean Sea, and in those off the Atlantic coast of the United States.

At as early a date as practicable after the close of the civil war, a systematic investigation was begun by deep-sea sounding and dredging, combined with observations of surface, serial, and bottom temperatures, and of currents, in the Gulf Stream and in the Gulf of Mexico.

In a communication made to the National academy of sciences in 1880 by J. E. Hilgard, M.N.A.S. (*Amer. journ. sc.*, April, 1881), upon a model of the Gulf of Mexico, a condensed statement is given of the results of the exploration of the basin of this great inland sea, as derived from the work organized by Benjamin Peirce and Carlile P. Patterson, superintendents of the U. S. coast-survey. This exploration was begun by Assistants L. F. Pourtalès and Henry Mitchell, U. S. coast-survey, with the aid of Master R. Platt, U.S.N., in 1868, and continued by Commanders J. A. Howell and C. D. Sigsbee, U.S.N., in 1872–74 and 1875–78, in the coast-survey steamer Blake. With the improved methods of sounding, and the mechanical appliances perfected by Commander Sigsbee, the work in the Gulf of Mexico was brought to a successful conclusion, and under Commander J. R. Bartlett, U.S.N., it was extended to the Caribbean Sea.

Sketch no. 21, Coast and geodetic survey report for 1879, shows the soundings in these waters and their approaches, in depths ranging from 100 to upwards of 3,400 fathoms.

Similar investigations have since been prosecuted by Commanders Bartlett and Brownson, U.S.N., under the direction of Superintendents Patterson and Hilgard of the coast-survey, in the western part of the North Atlantic, — that great embayment, which, limited by Newfoundland on the north, and by the Windward Islands on the south, might be not inaptly named the Gulf of North America.

The depths and temperatures obtained by these officers, upon lines run normal to the coast across the course of the Gulf Stream, and upon other lines connecting with those run by H. M. S. Challenger in 1873, are shown upon the accompanying chart. A reference to it will make apparent the part taken by the coast-survey in developing the configuration of the ocean-bed between the Bermudas and the West India Islands, and northward to the banks of Newfoundland, and in defining the limits of the continental plateau, which, extending from the coast to the 100-fathom line, may be described as the western rim of this great basin of the North Atlantic.

It was from these explorations that data were derived for the construction at the coast-survey office of the relief model of the western part of the North Atlantic, now on exhibition at the London international exposition of fish and fisheries.

Some interesting details of his work have been communicated by Commander Bartlett, who, during the summer of 1880, was engaged in dredging and sounding off the coast in the vicinity of Charleston, S.C. The first line run revealed the remarkable character of the bottom.

The first sounding and haul was made in 142 fathoms, south-east of Cape Romain. After this, in steaming to the eastward, taking frequent casts to find the depth at which it was desired to dredge, to their astonishment the water did not deepen as they expected. and they had crossed the supposed axis of the Gulf Stream before getting 300 fathoms at any sounding. Commander Bartlett, in his report, says, "The bottom was hard coral rock, but the sounding-rod always brought up small fragments of coral. We found but very few traces of animal life on this bottom, but made good hauls on its edge. For fifteen miles or more from the 100-fathom line we found a very strong current setting to the south-west. When the trawl was down, we tailed in that direction, and dragged at the rate of 2 knots without steam. When in the Gulf Stream, we found the current to the northward and eastward 2.6 knots per hour. The water deepened east of the axis to 382 fathoms, but shoaled again to 337 fathoms."

The lines run during this and the following season showed the same unmistakable plateau extending from Cape Hatteras to the Bahama Banks, the depths increasing but slowly until about 500 fathoms, after which they increased rapidly to the great Atlantic basin, at a depth of between 2,000 and 3,000 fathoms.

Commander Bartlett says in his report of the second season, after completing this work. "The eighteen lines of soundings run normal to the coast from Jupiter Inlet, Fla., to Currituck, N.C., by the steamer Blake; and the observations taken by the hydrographic party under my command gave very interesting data in regard to the physical features of the bottom

of the ocean over which the Gulf Stream flows. Instead of a deep channel, which has been previously reported, our soundings show an extensive and nearly level plateau extending from a point to the eastward of Bahama Banks to Cape Hatteras. Off Cape Canaveral it is nearly 200 miles wide, and gradually decreases in width to the northward until reaching Hatteras, when the depth is more than 1,000 fathoms within 30 miles of the shore.

"This plateau has a general depth of 400 fathoms, suddenly dropping on its eastern edge to 2,000 fathoms. The soundings in the strength of the current were all taken with the 60-pound shot-sinkers, the time allowed for the sinker to reach the bottom being less than one minute to each 100 fathoms in depth. Most of the soundings taken each side of the stream when not in strong current were taken with a 36-pound lead on the sounding-wire, the lead being reeled back. . . . It will be observed from the bottom specimens that the course of the Gulf Stream can almost be traced by the character of the bottom.

"On each side of the stream the sounding-cylinder brought up ooze. In the strength of the current, the bottom was washed nearly bare, the specimens being small broken pieces and particles of disintegrated coral rock. This bare portion was very hard, and the sharp edge of the brass sounding-cylinder came up very much dented and defaced."

During the summer of 1882 the Blake, under command of Lieut.-Commander W. H. Brownson, was engaged in sounding off New-York entrance. The charts have hitherto shown a spot about 100 miles south-east of Sandy Hook known as the '145-fathom hole.' In her soundings, the Blake discovered this hole to have a most remarkable character.

Its depth varies from 150 to over 450 fathoms, the bottom being mud; and in about the centre a knoll of mud, gravel, and shell rises up to within 64 fathoms of the surface. The dividing-ridge between the hole at its deepest point and the deep water outside has a least depth of 129 fathoms. There seems to be a continuation of irregular character of bottom, which extends from Sandy Hook about south-east; for about 200 miles farther the depth is over 3,000 fathoms, surrounded by very much shoaler depths.

During the past winter the vessel has been engaged in developing the limit and general character of the great Atlantic basin between Bermuda and Bahama, and along the outside of the West India Islands as far to the eastward as St. Thomas. This cruise has been of great interest. The bed of the Atlantic is shown to have a general depth of 2,700 or 2,800 fathoms; and depths of over 2,000 fathoms are found almost if not quite in sight of most of the islands along the outside of the Bahamas, and even in the narrow passages between them. In one place the 2,000-fathom curve was found to approach the shore to within two miles and a half, giving an inclination of the bottom of over 38 degrees.

Not the least gratifying point of interest of this cruise was the successful sounding taken at the enormous depth of 4,561 fathoms, which, it is believed, is the greatest depth from which bottom specimens and temperature have been obtained.

The soundings shown on the sketch represent but a small part of the work performed by the officers of the Blake, as only the characteristic ones have been selected from a total of nearly 2,000. During the time actually engaged in sounding, the Blake has steamed over 7,000 miles, and probably as much more in going to the working-ground, and in gaining positions after being obliged to abandon them from heavy weather, want of coal, or from other causes.

Bottom-soil specimens have been saved for examination, and densities of the sea-water obtained at nearly all the greater depths. About 1,200 surface temperatures have been taken; and the observations of the temperature of the water between the surface and the bottom will number about 1,300.

THE PROTOZOAN PARASITES OF THE OYSTER.

M. CERTES has recently described the protozoan parasites or commensals of Ostrea edulis and angulata, resorting to a method used by the writer in studying the contents of the stomach of the O. virginica during the past summer. A pipette is introduced through the mouth of the animal into its stomach. After it is filled with the brownish, dirty-looking contents of the gastric cavity, the pipette is withdrawn, and emptied upon a slide or compressor, and the material carefully examined under the microscope, in order to learn the nature of the bill of fare of the animal, and to detect the presence of endoparasitic organisms. As found by the writer in the American oyster, M. Certes states that the oyster is omnivorous. Amongst the contents of the stomach, more or less disorganized, grains of pollen, mites, algae, crustaceans, diatoms, foraminifera, radiolarians, and, at certain times of the year, a

great abundance of eggs and spermatozoa, were noticed by the above-mentioned observer. Amongst this *débris*, however, certain living organisms are always met with, often in great numbers, which may be regarded as parasites, or at least as commensals, inhabiting the digestive canal of the animal.

In the stomachs of specimens of O. edulis, from Cancale and Marennes, the author discovered Hexamita inflata Duj., which was also observed in the act of division in this unusual position; and, as it is also found in infusions and stagnant water, it is proved that it is a true commensal under certain circumstances.

Another organism was observed amongst the contents of the stomach, principally at its anterior part, which might at first be regarded as a Spirillum of relatively large size. It varied in length from 0.04 to 0.12 mm., and in thickness, from 0.001 to 0.003 mm. It was found to have a vibratile frill attached, which was arranged spirally on the body, making two, three, rarely eight or ten, turns around it. This thin vibratile film was demonstrated in the living specimens by the use of aniline colors, dahlia, and methyle blue, and also by killing the creatures with the fumes of osmic acid, and afterwards staining with the colors named. M. Certes regards this organism as related to Trypanosoma sanguinis, — described and figured in 1843 by Gruber as a parasite of the blood of the frog, and rediscovered by Ray Lankester, and named Undulina ranarum, — and Trypanosoma Eberthii of Saville Kent, found in the intestine of the duck. For the parasite found in the oyster, M. Certes proposes the name of Trypanosoma Balbianii.

Besides the foregoing, a small species of Enchelyodon was found in the liquor which had been kept covered for some days from Marennes oysters, as well as in the fresh juices which escaped when the shell was opened. Prorocentrum micans Ehr. was also noticed. A plate containing twelve figures accompanies the paper noticed (*Bull. soc. zool. France*, vii. 1882).

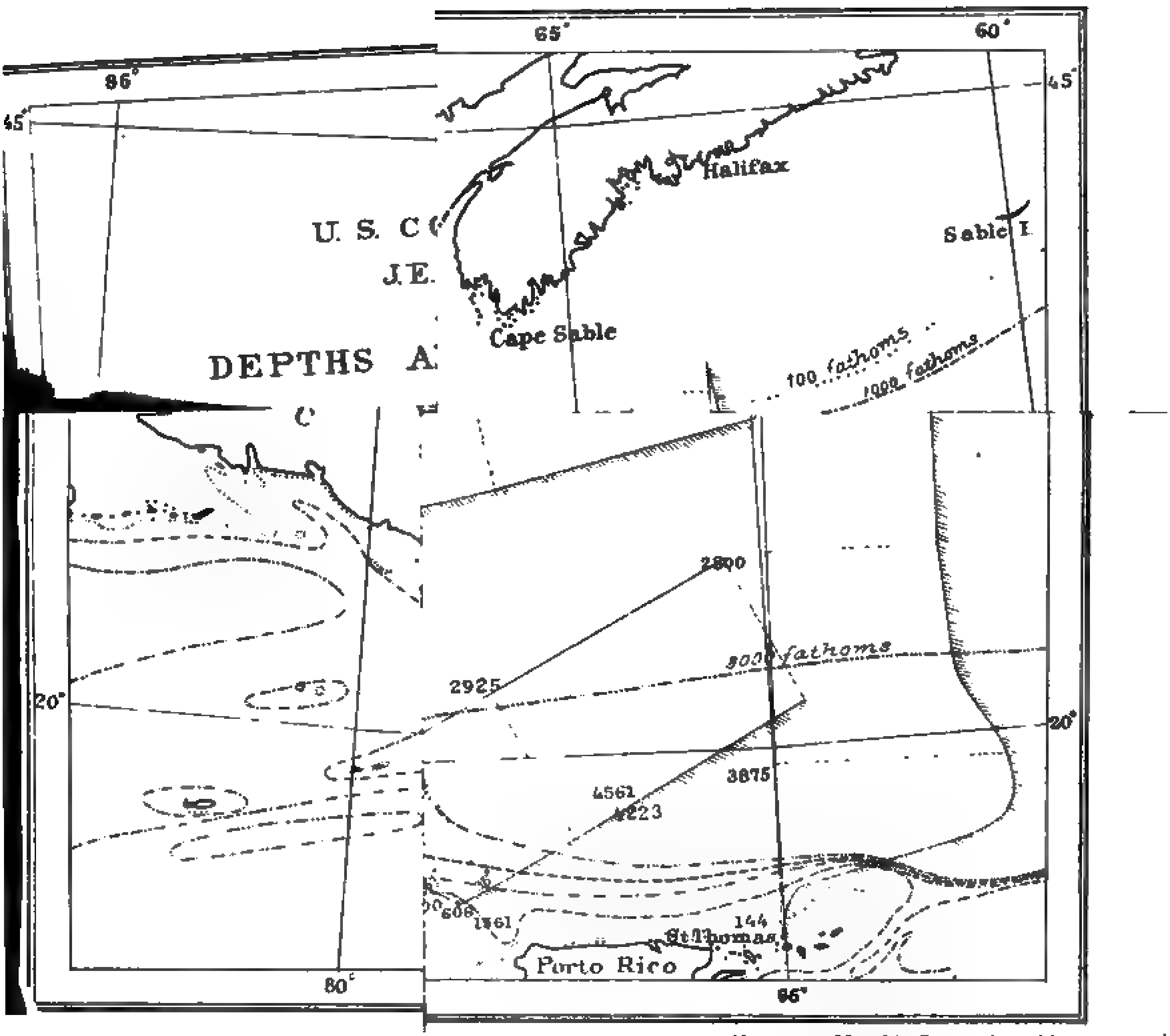
The organism which M. Certes has described as Trypanosoma Balbianii is probably the same as that commonly met with in the stomach of Ostrea virginica, and which I had proposed to call Spirillum ostrearum in a paper prepared last September for the census report. Its behavior was so like that of a Spirillum which I have at times found in the foul, stagnant waters of the gutters in the streets of towns, that it seemed to me that it was a vegetable organism belonging to the schizomycetous fungi. The French naturalist is probably right, however, as to its systematic position, unless the form found in Ostrea virginica is entirely different, which I think altogether unlikely. Sachs (Text-book of botany, 2d ed., 1882, p. 248) says, "The Schizomycetes live in fluids which contain organic substances (albuminoids) liable to putrefaction, from which they obtain their nutriment, and of the putrefaction of which they are the cause." While it is hardly fair to say that putridity characterizes the contents of the alimentary canal of the oyster, yet the conditions favorable to the growth and multiplication of low organic forms are probably present. We usually found this organism present in oysters examined by us: in fact, sometimes countless multitudes were present, especially in the stomach and around the crystalline style and the intestinal pouch or fold in which the latter is lodged. Yet, upon eating these same individuals known to be infested with parasites, no inconvenience was experienced, showing that these organisms, whatever they may be, are probably harmless to man.

I have alluded to a singular association of messmates, found inhabiting the cavity of the mantle of the American oyster, in my report to the Maryland commissioner for 1881 (Appendix A, pp. 24–25). The little oyster-crab Pinnotheres ostreum Say was found to support colonies of the vorticellid Zoothamnium on its back and legs. The infusorian, in its turn, supported on its stalks very minute Bacteria and Vibriones. In such a case, the colonies of infusorians may be of actual benefit to the oyster, since many of the zoöids thrown off doubtless become food for the host.

J. A. RYDER.

THE USE OF STEEL SOUNDING-WIRE BY LIEUT. J. C. WALSH, U.S.N., ON THE TANEY, IN 1849-50.

Two notes on this subject have been published by Mr. W. H. Dall in SCIENCE (No. 3, p. 65; and No. 7, p. 191). In these, Mr. Dall refers to the log-book of Lieut. Walsh, when in command of the Taney, as if it were still unpublished. Nor does he give any references to the detailed report of the expedition, made by Lieut. Walsh to Lieut. Maury, as ordered by the secretary of the navy. This report was dated Aug. 15, 1850, and was printed in 1851 in connection with the 'Abstract log of the Taney,' which includes all the observations in tabular form, with a column of remarks, as a part of 'Lieut. Maury's Investigations of the winds and currents of the sea,' Appendix to



SCIENCE, No 20, June 22, 1883.

the Washington astronomical observations for 1846 (National observatory, 1851). The special report of Lieut. Walsh occupies pp. 55-62; the log covers pp. 64-99. Together, they include a large amount of valuable and original data in regard to a wide area of the Atlantic in the region of the Gulf Stream, and to the eastward of it, including the 'Sargasso Sea,' etc.

In Mr. Dall's second paper he states that 'it appears' that the wire used 'was of steel, though this is not stated in the log-book.' As this is explicitly stated in the printed report of Lieut. Walsh, it is possible that Mr. Dall has not consulted the latter.

The following description of the wire and apparatus used is to be found on p. 56. It is of interest to notice that this early apparatus was much like the modern improved machines in several respects.

"Our arrangements for these deep soundings were altogether very complete. It may be well to add an account of them. We had on board 14,300 fathoms of wire, weighing 3,025 lbs., all of the best English steel, of five different sizes, Nos. 5, 7, 8, 10, and 13 (Birmingham gauges). Every part was tested to bear at least one-third more than the weight which it was calculated to sustain.

"An extent of 7,000 fathoms of this, weighing 1,800 lbs. (the remaining 7,300 fathoms, composed of the smaller sizes, Nos. 10 and 13, being stowed away as spare wire), carefully measured and marked with small copper labels, was linked into one piece, and wound upon an iron cylinder, three feet in length and twenty inches in diameter, — the largest-sized wire being wound first, so as to be uppermost in sounding. Two swivels were placed near the lead, and one at each thousand fathoms, to meet the danger of twisting off by the probable rotary motion in reeling up. The cylinder with the wire was fitted to a strong wooden frame, and machinery attached — fly-wheel and pinions, to give power in reeling up. Four men at the cranks could reel up with ease, with the whole weight of wire out. Iron friction bands, which proved of indispensable importance, were connected to regulate the rate of the wire in running off the reel. One man with his hand upon the lever of one of these friction bands could preserve a uniform, safe velocity, checking or stopping the wire as required. The whole apparatus could be taken apart and stowed away in pieces (being so large and massive, this was indispensable in so small a vessel as the Taney). When wanted for use, the frame was put together and secured to the deck by iron clamps and bolts, near amidships, the reel hoisted up from below and shipped in its place; a *fairleader* was secured to the taffrail, being a thick oak plank, rigged out five feet over the stern, having an iron pulley, eighteen inches diameter, fitted in its outer end, and two sheet iron fenders 3½ feet long, of semicircular shape, fitted under it, to guard the iron wire from getting a short nip in the drifting of the vessel. The wire was led aft, from the reel, over the pulley which traversed freely in the fairleader, and passed between these fenders into the water.

"The time occupied in the descent of *the* 5,700 *fathoms*, at the moderate rate it was allowed to go off the reel, using the friction bands, was exactly 1½ hours. I found in the subsequent soundings [see May 14], that two or three men could reel up 1,000 fathoms in 2½ hours, taking time to rub dry and oil it in passing to the reel, to guard against rust."

In the trial referred to, it is stated that a ten-pound lead, with a Stellwagen cup, and a six-pound instrument for indicating depth, were attached to the wire.

The following account of this first use of the steel wire, on Nov. 14, 1849, extracted from the published log of the Taney (p. 69), is of interest at the present time. Lieut. Walsh, in this connection and elsewhere, expressed great confidence in the accuracy of this determination of depth, though it has been regarded by others (perhaps without sufficient reason) as unreliable.

"At 1 h. 25 m., P.M., started the wire machine, and at 2 h. 55 m., P.M., had reeled off 5,700 fathoms, *dead up and down*, without striking bottom, when the wire parted at one of the links on the reel. We had observed some of the links of this large sized wire to catch at times on others upon the reel, endangering a break, and in consequence, at the time it parted, we were reeling off very slowly and carefully checking it by the friction band, which worked admirably. A link going off the reel caught in another under it upon the reel and before it could be extricated, it snapped in the middle of the link. This was the largest-sized wire, No. 7. The whole time of reeling off, the wire went down *perfectly plumb* — it served as an anchor to keep the vessel steady, and there was at no time a variation of one-half a degree from the '*plumb*.' We were highly encouraged, expecting to strike bottom every moment, and our sorrow and disappointment upon the break and loss of the wire, great indeed."

This locality was in N. lat. 31° 59′, W. long. 58° 43′, east of the Bermudas, and not very far from the part of the Atlantic where the greatest depths known have subsequently been found. But this particular region apparently has not been re-examined. If correct, this sounding would be more than 1,000 fathoms deeper than any other that is authentic.

Lieut. Walsh appears to have fully appreciated the main cause of the several failures with the wire.

"In all our subsequent work under this head, I found the heave of the sea, however slight, was the great difficulty — the lifting of the stern in the pitching motion causing such an immense increase of strain upon the wire, breaking it upon almost every occasion on reaching about 2,000 fathoms."

Probably the use of heavier leads would have increased the liability of the wire to break from this cause. This trouble is remedied, in the modern sounding-machines, by the use of vulcanized rubber springs or 'accumulators,' which relieve the sudden strains

upon the wire. Therefore there is no good reason to think that any thing would have been gained at that time by the use of heavy leads, though Mr. Dall thinks it strange that they were not tried. In some of the trials a twelve-pound lead was used, and, in the last attempt, one of eight pounds, together with a thermometer, with the usual result, — a breakage of the wire.

Mr. Dall's note implies that no successful trials were made with the steel wire; but, according to the *published* log (p. 93, May 14, 1850), at least *one* sounding was made (1,050 fathoms, no bottom) when the wire was successfully recovered. A. E. Verrill.

LAKE BONNEVILLE.

Mr. G. K. Gilbert's report (*Ann. rep. U. S. geol. surv.*, 1881, 169), preliminary to the monograph (in preparation) he promises on the Great Basin, shows the following history for its old lake. The lake-deposits are chiefly a yellow clay of unknown depth, covered by a white marl ten to twenty feet thick, the two being separated at certain points along the old shore-lines by wedges of subaerial gravel-deposits, and some exposures showing erosion of the clay surface before the marl was laid on it. These deposits mark two periods of high water, separated by a time of low water, or dryness. As no cause is found in the surrounding country to account for the change from clay to marl deposit, its explanation is sought in a change from salt water of the first lake period to fresh water in the second, for which a theoretic explanation is given; but the evidence for this is not considered final. From a critical study of the superposition of many shore terraces (see the plate opposite), it is shown that the first lake did not rise high enough to reach an overflow outlet; that the greater number of terraces now visible were formed during halts in the rise of the second great lake; that the highest or Bonneville terrace, nine hundred or more feet above the present Great Salt Lake, marks a stand at the level of overflow northward to Snake River; that the next most pronounced terrace, known as the Provo, four hundred feet lower, marks a halt in the drainage of the waters when the outlet had been cut down through softer rocks to a hard limestone sill. The reduction of the lake-surface to a still lower level, as in the present shallow sheet of water, has been effected entirely by climatic change, by which the ratio of precipitation to evaporation has been decreased. When at its highest level, Lake Bonneville was three hundred miles long between latitudes 37° 40′ and 42° 20′, and one hundred and seventy miles broad between the meridians 111° 35′ and 114° 15′ of west longitude. Its shore-line was very irregular, advancing around broken promontories, and retreating into fiord-like bays. Numerous islands stood above its broad, deep, fresh waters, and from its shores the enclosing mountains rose five to eight thousand feet. Now it is represented by a mere film of brine on the borders of a desert plain. Previous to the rise of the first lake, the base-level of the basin drainage was low for a long period, as is proved by the distinct overlap of the lacustrine deposits on the eroded mountain-slopes, as shown in the second plate here copied on p. 573, or on the alluvial cones built by old streams flowing from the mountain valleys; but the conclusion that this long period had a dry climate is not fully proved. For if, as is mentioned below, a considerable tilting has already deformed the recently made Bonneville terrace, one may fairly suppose a much greater distortion in the long time since the beginning of the first lake; and this distortion may have been sufficient to raise a barrier behind which the lake-waters accumulated. The change from the prelacustrine condition would then have been orographic rather than climatic. The relation of the glaciation of the neighboring ranges to the lakes is not shown directly, although three old moraines are found within the terrace limits; for none of these give good opportunity for observation, and the one at the mouth of Little Cottonwood cañon is so dislocated by recent faulting that its attitude with relation to the terraces cannot be deciphered. Recent discoveries by Mr. I. C. Russell in the western part of the Great Basin may throw further light on this question. Volcanic eruption took place in the basin during the disappearance of Lake Bonneville; and both the Bonneville and Provo terraces have been warped from their originally level plains, and by different amounts. From measures taken along the eastern shore-lines, lines of equal deformation are constructed; and these show very clearly a relative elevation of the centre, or south-western part, of the old lake-bottom of as much as three hundred feet since the Bonneville terrace was made, and a hundred and twenty-six since the Provo. This tilting accounts for the eccentric position of the present shallow lake-remnant at the north-eastern margin of its flat desert. A fault of fifty to seventy-five feet has been made along the foot of the Wahsatch range, between Willard and Levan, since the lake lost its outlet. The author therefore concludes that volcanic activity and mountain growth have not yet ceased in this neighborhood.

Special interest is attached to this investigation, as it is the first detailed study of an example of those great interior lakes so numerous at a comparatively recent period of the earth's history, and now so greatly reduced in area, or even converted into saline or sandy deserts. The largest of these was probably the one that united the Aral and the Caspian; another vast interior sea occupied much of what is now the desert of Gobi; and smaller examples could be named in the Argentine Republic and in northern Mexico. Central Africa, lying within the belt of heavy equatorial rains, still preserves a climate moist enough to fill its lakes to overflowing; but the recent drying-up of the outlet of Tanganyika shows that the change so distinct elsewhere is beginning to make itself felt even there. It will be long before any of these other great basins is known as well as that one so carefully studied by our government surveyors.

W. M. Davis.

CHEMICAL AND PHYSIOLOGICAL RESEARCHES ON THE PTOMAÏNES.

During the last few years much attention has been directed to the study of the chemical nature and physiological action of the so-called *post-mortem* alkaloids (or ptomaïnes). These mysterious bodies, which are apparently formed in such small quantities as to make their detection and separation an extremely difficult operation, were originally regarded by both Selmi[1] and Schwanert[2] (1874) as exclusively

[1] Abstract in *Berichte deutsch. chem. gesellsch.*, vi. 142.
[2] *Berichte deutsch. chem. gesellsch.*, vii. 1332.

RESERVOIR BUTTE, SHOWING TERRACES OF THE BONNEVILLE SHORELINES.

products of cadaveric putrefaction. Later, Selmi saw cause to believe that these organic bases, in serious pathological changes, might be produced in the animal organism during life, a view which was confirmed by Spica in 1881. Further experiments by Paternò and Spica on blood and egg albumen, and likewise those of Gautier on normal urine, showed, that, by the methods employed, reactions could be obtained from these healthy animal fluids similar to those which served to identify the ptomaïnes. Again: in 1881 Gautier communicated the discovery of a non-proteid, ptomaïne-like alkaloid, with poisonous properties, in normal human saliva, not destroyed by heat, and yielding crystalline gold and platinum compounds. Bujwid,[1] however, has tried physiological experiments on frogs and pigeons with the concentrated alcohol-water extract from 100 cc. of boiled saliva, and could obtain no poisonous action whatever. Griffin,[2] while endeavoring to explain Vulpian's results on the toxic action of human saliva, came to the following conclusions from injection experiments on rabbits: pure parotid saliva produces neither local nor general pathological changes when injected subcutaneously; filtered mixed saliva, containing, however, recognizable microphytes, produces no local effect, but causes an infection which finally becomes fatal; impure saliva of the mouth, collected while fasting, and injected under the skin, produces both a violent local action and a septic-like infection. The infection obtained in all of the experiments Griffin considers as a form of septicaemia, produced by a substance in solution in the saliva, and not due to microphytes. The local effects, however, produced by the impure mixed saliva, are not to be ascribed to either of the above, but to the partially putrid substances suspended in the fluid. These, when injected, are retained by the subcutaneous tissue, and thus give rise to irritation, finally producing gangrene; and, at the same time undergoing further decomposition, new putrid products are formed, which are absorbed, thus giving rise to a secondary infection. Coppola,[3] in a similar manner, has made a series of experiments on the physiological action of bases extracted from the blood of a healthy dog, which led him to believe that bodies extracted from healthy animal fluids, carefully protected from putrefactive alteration, may exhibit strong toxic properties, and therefore the albuminoid substances must be capable of undergoing certain transformations, aside from those produced by putrefaction, which may give rise to poisonous alkaloids. This view is in part substantiated by the recently published results of Brieger,[4] who found, that, by the digestion of raw fibrine with gastric juice, peptones are formed, which, although free from all products of putrefaction (indol, phenol, oxyacids, etc.), yield to alcohol and amyl alcohol an amorphous brown mass, which, even in small quantities, acts as a poison upon frogs and rabbits. .05–.1 gram of the sirupy extract was sufficient to kill a frog in fifteen to twenty minutes; while, with rabbits of one kilogram weight, .5–1 gram of the extract was required to produce the same effect by subcutaneous injection. The poisonous action is first manifested in a gradual paralysis of the extremities; after which the animal falls into a semi-comatose condition, and soon dies. The substance or substances formed in this manner react with all of the general alkaloid reagents, and are not readily decomposed by long boiling, nor by the long-continued action of hydrogen sulphide. Length of time, in the digestion of the fibrine, appears to exercise but little influence on the amount of the toxic substance formed. The same product was also obtained, in one case, from von Wittich's dry peptone. The poisonous substance does not come from the amyl alcohol, nor from the gastric juice; neither does undigested albumen yield any poisonous substance when extracted with amyl alcohol. Brieger's results thus confirm the previous statements of Schmidt-Mülheim, Hoffmeister, Fano, and others, that peptones, injected into the blood or under the skin, exert a poisonous action, though it would now appear that the action is not due to the peptones themselves, but to a substance formed simultaneously with them, and which can be partially separated by ethyl and amyl alcohol. Just here it is worth noticing the recent interesting discovery of Mitchell and Reichert, that the poisonous action of rattlesnake and moccason venom is due to the presence of two albuminous bodies, which, from their properties, they name *venom-peptone* and *venom-globulin*. Brieger also saw cause to believe that neurin, by oxidation, is changed into a body similar to, if not identical with, the extremely poisonous muscarin; also that a solution of neurin, on long standing in contact with air, is partially changed into poisonous products, which, by further putrefactive decomposition, disappear with formation of trimethylamine, and a substance volatilized when boiled with water.

It would thus appear that healthy animal fluids may contain substances capable of poisonous action, and also that albuminous matter may undergo changes other than putrefaction by which toxic substances may result; all of which tends to throw a shadow of doubt on the existence of distinctive *post-mortem* alkaloids. That poisonous bodies (or ptomaïnes) do result from the putrefaction of organic matter, there can, however, be but little question; and the recent work of Guareschi and Mosso,[1] of the university of Turin, is, in this connection, well worthy of notice. These investigators have made a systematic study of the products of the putrefaction of brain, blood, and fibrine, under varying conditions, and have fully established the formation of one or more poisonous alkaloids.

As preliminary to the actual work, a careful examination was made of the methods more commonly used for the extraction of ptomaïnes, in which it was found that the common extractives employed may contain traces of alkaloid substances. Thus, by the evaporation of large quantities of alcohol (fifty litres) in the presence of tartaric acid, a small residue was obtained, giving the alkaloid reactions with chloride of gold, phospho-molybdic acid, etc., and containing a trace of an alkaloid substance similar to pyridine, thus confirming the results of previous investigators; viz., Pinner, Krämer, and others.

In the amyl alcohol of commerce pyridine was likewise detected, in one case to the extent of 0.5 per thousand. Platinum and gold salts were made and analyzed. From six litres of crystallizable benzine a quantity of pyridine was also obtained sufficient to furnish chloroplatinates for analysis. The authors therefore conclude that all previous results obtained by different investigators from alkaline extracts by the use of either amyl alcohol or benzine, unless carefully purified, are absolutely without value as deciding the presence of ptomaïne-like bodies in fresh tissue or fluids, or their formation in the putrefaction of such material.

In the search for ptomaïnes in putrescent brain-

[1] *Virchow's archives*, xci. 190.
[2] *Archives ital. biol.*, ii. 106.
[3] Abstract in *Journ. chem. soc.*, 1883, 523.
[4] *Zeitschrift physiolog. chem.*, vii. 274.

[1] *Archives ital. biol.*, ii. 367.

VIEW ON GREAT SALT LAKE DESERT, SHOWING MOUNTAINS HALF BURIED BY LAKE-SEDIMENTS. (See page 370.)

matter, Guareschi and Mosso followed the method of Stass-Otto, applying exactly the same procedure in the control search with fresh brain-tissue; and, on account of the negative results invariably obtained in the latter, the authors are able to guarantee the absence of pre-existing ptomaïnes in fresh flesh, or of any substances similar to those which are found after putrefaction, when pure ether or chloroform is used in the extractions. In the experiments, 36 kilograms of brain-tissue were placed in a glass balloon, and left at a temperature of 10°–15° C. for one to two months. The mass was then extracted with alcohol acidulated with tartaric acid, using, in all, 147 litres of alcohol. The final ether solution left an alkaline residue, which, dissolved in dilute hydrochloric acid, gave characteristic precipitates with the general alkaloid reagents, and several well-defined colored reactions; but, though present, the ptomaïnes (or alkaloids) were in far too small quantity to admit of determining their composition by analysis. Trimethylamine, coming, doubtless, from the lecithin present in the brain-matter, was likewise obtained, together with an abundance of basic and ammoniacal products.

Physiological experiments, made on frogs with both aqueous and ether extracts, of the putrid brain-matter, led to the conclusion that the ptomaïnes formed possessed an action analogous to that of curare, though less energetic. A few drops of the extract, applied directly to the detached heart of a frog immersed in a .7 % salt solution, exercised upon it an immediate effect, diminishing the frequency of the systole and diastole, but increasing the vigor of the pulsation. In studying the action of the extract on nerves and muscles, a frog was rendered motionless by destroying the spinal cord; after which the achilles tendon was prepared in the usual manner, the sciatic nerve being placed upon the electrodes, and excited every ten seconds. .3 cc. of the ptomaïne containing extract was then injected under the skin of the back. After ten minutes, an irregularity appeared in the contraction of the gastrocnemius; and, since all the conditions of the experiment remained the same, the irregularity is to be ascribed to the poison. From this point the contractions were no longer regular: they gradually diminished little by little, and finally ceased altogether. On increasing the force of the irritation, there was still no further movement. The sciatic nerve of the other side, intact, had likewise lost its excitability, and the animal was in as complete a state of muscular relaxation as if it had been poisoned by curare. But the pupil was dilated, and the heart motionless.

In order to obtain the ptomaïnes in larger quantities, recourse was had to blood-fibrine. Large quantities of fibrine (140 kilos) were allowed to putrefy for five months; at the end of which time it was transformed into a thick fluid holding a small quantity of solid matters in suspension; the reaction being strongly acid, and the odor very intense at the commencement, but less strong later. For the extraction of the alkaloids, the method of Gautier and Étard was followed; the final slightly alkaline fluid being extracted successively with chloroform, in all, twelve times. By evaporation of the chloroform, an oily residue was left with an odor of scatol and of pyridine (or cicutine). This residue was purified by solution in tartaric acid, decolorized by extracting the acid solution with ether, and then reprecipitated by an excess of potassium hydroxide in the form of oily, brown droplets, which quickly rose to the top of the fluid. This precipitate was readily dissolved by ether, and, on evaporation, was left as an oily, brown residue with strong alkaline reaction, only slowly soluble in water, and then rapidly transformed into a resin. A hydrochlorate was readily obtained, crystallizing in fine lamellae, sometimes rectangular, resembling somewhat the crystals of cholesterin. With a solution of the hydrochlorate, auric chloride gave a yellow crystalline precipitate, followed by the reduction of the gold; platinic chloride, an abundant pale-yellow crystalline precipitate; iodine in potassium iodide, a kermes-brown precipitate; phosphotungstic acid, a pale-yellowish precipitate, etc. Chloroplatinates from seven different chloroform extractions were prepared for analysis by treating a solution of the hydrochlorate with an excess of platinic chloride. An immediate deposition of a flesh-colored precipitate, light and crystalline, insoluble in water, alcohol, and ether, took place. Dried at 100° C., the analyses of the various products showed essentially the same composition, pointing to the presence of only one ptomaïne in this putrefaction. The results correspond more or less closely with the formula $(C_{10}H_{15}N . HCl)_2PtCl_4$, the ptomaïne itself being probably $C_{10}H_{15}N$. Bodies having the same apparent or closely related composition have been previously discovered: coridine, a homologue of pyridine, found in the oil of coal-tar by Thenius; a base, $C_{10}H_{15}N$, discovered by Vohl and Eulenberg in the fumes of tobacco, also termed coridine; a base obtained by Neucki[1] in the putrefaction of gelatine with pancreas, and which he deemed an isomer of collidine.

He[2] considered its constitution to be expressed by $C_6H_5 - CH \langle {CH_3 \atop NH_2}$, that is, isophenylethylamine, and that it is derived from the putrefaction of tyrosin, a normal product of pancreatic digestion, according to the following equation:—

$$C_9H_{11}NO_3 = C_8H_{11}N + CO_2 + O.$$

Gautier and Étard,[3] while studying the alkaloid-like bodies produced by putrefaction, isolated two bases, which, from the analyses of the platinum salts, corresponded to parvolin and hydrocollidin. Sonnenschein and Zuelzer[4] obtained from flesh extracts, which had become putrid by standing at 25° C. for several weeks, a small quantity of a crystalline substance, which behaved similar to atropin, dilating the pupil of the eye, and increasing the pulsation of the heart, etc. There is also a noticeable similarity between the ptomaïne obtained by Guareschi and Mosso, and the tetrahydromethylquinoline of Jackson. The physiological action of the alkaloid from putrefied fibrine is analogous to that of the ptomaïne from putrid brain-matter. Guareschi and Mosso propose to experiment further in the hopes of better establishing the nature of the ptomaïne in question, and to make clear its origin and constitution.

R. H. CHITTENDEN.

LETTERS TO THE EDITOR.

Precocity in a chicken.

A BRAHMA chicken — now five weeks old, and raised by my boy — was brought into the house two weeks ago with a broken leg. On the same day a weak chicken, just out of the egg, was also brought in; and after two or three days both chickens were

[1] Ueber die zersetzung der gelatine und des eiweisses bei der faulnis mit pankreas. Bern, 1876.
[2] *Journ. prakt. chem.*, xxvi. 51.
[3] *Comptes rendus*, xciv. 1208.
[4] *Berliner klinische wochenschrift*, 1869, No. 2.

kept in a box together. The older chicken soon assumed the care of the little one, brooding it after its fashion, and pecking any disturbing hand. But the strangest feature is, that when a dainty morsel, such as a fly, is brought, it will call the little one like a mother-hen, and give it the fly to eat. This has been done repeatedly within the past week, the sound made being unmistakably the food-call, though, of course, pitched on a higher key. Yet it cannot have heard that sound for at least two weeks, and, in the ordinary course of events, should not *make* it for eight months. REDDUCS.

Cambridge, June 6.

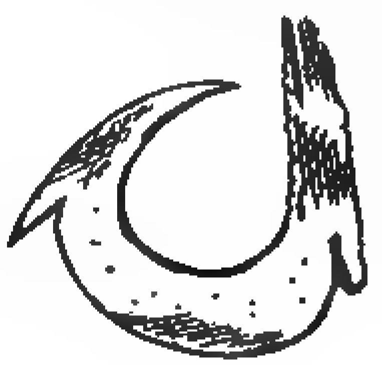
Lake Superior geology.

On reading Professor Chamberlain's paper in SCIENCE, No. 16, and afterwards referring to his statement in the third volume Wisc. geol. reports (p. 423), I see that I was mistaken regarding the Taylor's Falls locality being fifteen miles away from other traps (SCIENCE, No. 9). I now see that his language was not intended to be taken as it was understood by me.

M. E. WADSWORTH.

Fish-hooks from southern California.

In plates xi. and xii. of Lieut. Wheeler's Report on archeology there are several drawings of ornaments found near Santa Barbara, Cal., and on the adjacent islands, by Mr. Paul Schumaker and myself, which the editors are pleased to call fish-hooks. A writer in the *Century magazine* for April presents drawings of other specimens of like character, found by myself in the same locality, and now deposited in the Smithsonian institution. I also have in my possession a series of these ornaments, but it would require a broad stretch of the imagination to believe that they were intended for fish-hooks.



SHELL ORNAMENT. BONE ORNAMENT, SIZE OF ORIGINAL.

The point, which in many instances curves downward, comes so near the stem that it would be next to impossible for them to become hooked in a fish's mouth. The point of one of my best specimens, manufactured from the shell of the Haliotis, comes within the sixteenth of an inch of the stem or shank ; and were a line to be looped on the stem, and cemented with asphaltum, as was practised by the California Indians, the space would be completely filled (see the annexed drawing). My specimens range in size from one-half inch to two and a half inches in diameter, and were manufactured from Haliotis shells and from bone. The first of these ornaments of which I have any knowledge, I found in a rancheria at Rincon, on the line between Santa Barbara and Ventura counties ; and during five years' subsequent residence at Santa Barbara, and the exploration of the mainland and islands, I had an opportunity to study them in every stage of development. I am convinced, that, with few exceptions, they were designed for ornaments, as their shape precludes the idea of their use as fish-hooks. They were probably suspended from the ears, and possibly worn on other portions of the body. The true fish-hook of what may be termed the Santa Barbara Indians has never, to my knowledge, been figured ; yet they are more commonly met with in the rancherias and 'cementaries' in Santa Barbara and Ventura counties than the curved specimens we have been considering. I send you drawings of two specimens belonging to my cabinet. These hooks were made of two slightly curved pieces of bone pointed at each end, and firmly tied together at the lower end and cemented with asphaltum. They are somewhat similar to those still in use by the South Sea Islanders. The larger specimen I found with a skeleton at Point Dume, Ventura county. There were several others similar to the one figured still retaining the thong and cement that bound the parts together. The smaller specimen I found on the surface in a rancheria one mile west of the town of Ventura.

FISH-HOOK, SIZE OF ORIGINAL.

FISH-HOOK, SIZE OF ORIGINAL.

STEPHEN BOWERS.

Falls City, Neb., June 4, 1883.

Intelligence of the crow.

I find, by referring to my note-books, that I have witnessed several times the occurrence of crows breaking mussels by dropping them from considerable heights (SCIENCE, p. 513). In one instance, I had my field-glass with me, and made careful notes of what took place. The crows had assembled on Duck Island, in the Delaware River, and were busily engaged in running along the edges of the sand-bars, exposed at low tide. Every few moments, one of them would rise up to a height of fully fifty feet, carrying a mussel *in its beak*, and, flying inland to a distance of one hundred yards, would let the mollusk fall on the meadow. Usually the force of the fall was sufficient to break the shell. The crows, as soon as they had let fall their burden, immediately returned to the island and bars, and gathered more mussels. This was continued until the returning tide made mussel-hunting impracticable. In no instance did the crows carry the food they were gathering by their feet. There is one fact with reference to this habit of the crows which is, I think, indicative of greater intelligence than the mere fact of lifting an object and dropping it in order to break it. This is, that all the mussels so dropped were left undisturbed until the returning waters made further fishing impracticable, when the birds hastened to feast on the results of their intelligent labor. Marvellous as it may seem, these crows recognized the nature of tides, and, *knowing* their time was short, made as good use of it as possible.

If any more striking evidence of intelligence on the part of birds can be produced, let it be placed on record forthwith. C. C. ABBOTT.

Impregnation in the turkey.

An interesting fact respecting our domestic turkey has recently come to my notice. A friend, finding that a stray turkey had recently come upon his premises with the intention of remaining, finally shut it up in his chicken-yard, where it was permanently confined with no other associates than the chickens. The prisoner at once began to lay eggs, and, after a nest was formed, sat upon them, hatching out, in the usual time, nine healthy turkeys. Three others, that had been hatched by a hen, died soon for want of care. The eggs, thirteen in all, were laid without any connection with a turkey-cock. An impregnation, then, that must have taken place before the fowl was placed in confinement, must have answered for all the eggs. Agassiz states that one copulation is supposed to answer for more than one egg in the case of the turkey, but adds that the supposition needs confirmation. The facts here mentioned seem conclusive, as there was no possible way in which connection could have taken place after the turkey was confined. EDWARD M. SHEPARD.

Springfield, Mo.

THE GRAPE PHYLLOXERA IN FRANCE.

Compte rendu des travaux du service du Phylloxera. Année 1882. Procès verbaux de la session annuelle de la Commission supérieure du Phylloxera. Rapports et pièces annexes. Lois, décrets et arrêtés relatif au Phylloxera. Paris, *Impr. nat.*, 1883. 603 p. 4°.

THE *Compte rendu des travaux du service du Phylloxera* for the year 1882, just received in this country, makes a large volume, containing numerous reports of special committees and delegates. The *Commission supérieure du Phylloxera*, which consists of some thirty-seven members, including such well-known investigators as Dumas, Pasteur, Tisserand, Cornu, Balbiani, Marion, Marès, with a number of deputies and senators, was convoked by the minister of agriculture on the 19th of January, 1883. The first sub-committee at the session of Jan. 22 submitted its report, which was accepted by the *Commission supérieure*. This report may be thus summed up: —

After having passed upon 185 proposed remedies, they were unable to award the prize of 300,000 francs offered by the government in 1874, as they recognized in none of the new propositions any merit, whether as to novelty or more desirable methods of application of any insecticide already known. As in previous years, the substances most often recommended were salt, lime, soot, and cinders. It is well known that salt has produced nothing but bad effects on the vine, lime has amounted to little, while soot and cinders are but adjuncts to other modes of treatment. Among plants, Pyrethrum, tobacco, Quassia, and other similar products, are still urged by applicants for the prize, notwithstanding that the uselessness of such products has been shown by past experience. In fact, the proposed remedies range from dynamite and electricity to prayers and processions.

The second sub-committee reported through its chairman, M. Cornu, on the spread of the insect through France, the report being accompanied by a map which shows that nearly one-half of France is infested with Phylloxera. The map indicates particularly (1) the 'arondissements' in which the presence of Phylloxera has not yet been observed, and into which it is forbidden to introduce any vines from phylloxerated districts or from foreign countries; (2) districts in which the insect occurs quite generally, but into which the introduction of foreign vines, or vines from other phylloxerated districts, is not authorized; and (3) badly infested districts, into which the introduction of foreign and French vines from phylloxerated districts is authorized. These last constitute nearly one-third of the area of France.

It will be well for those, who, allured by the liberal offer of the French government, venture to propose a Phylloxera remedy, to remember that one of the absolute conditions for the awarding of the prize is that the remedy shall be based on positive and authentic experience. A great many visionary and theoretical propo-

sitions have been sent to us of late years with a request that we assist the proposers in presenting their claims to the French government. In almost every instance the proposers have shown an absolute lack of experience, both as to the insect and as to the methods they recommend.

The question of the winter egg, so called, has again occupied much of the attention of the commission, which places great confidence in the researches in regard to it of one of its eminent members, Balbiani, who has been instructed to continue his investigations. In reference to this egg, and the importance of destroying it, there has, of late, been much discussion in France; and we may repeat our answer to the following question, recently put to us by one of the first French investigators into the life-history of Phylloxera: —

"*L'oeuf soi-disant d'hiver de M. Balbiani est-il indispensable à la reproduction du Phylloxera, ou bien la reproduction agame vous parait-elle possible durant plusieurs années ou même indéfiniment?*"

Our reply was, that the impregnated egg (we prefer this term to 'winter egg') is indispensable to the continued reproduction of Phylloxera, and that normally it is produced annually in the cycle of the insect's life; but that agamic multiplication may, under favoring conditions. extend to the third or fourth year, and, for aught we know, longer.

In reading over Targioni-Tozzetti's criticism of Balbiani, and the latter's reply, in late numbers of the *Comptes rendus de l'académie*, we felt, that, so far as our own observations and experiments have gone, both were in a degree right, and both wrong. There is no question but that Balbiani is essentially right in his conclusion as to the necessity for the impregnated egg at some period during the annual development, under the conditions of our changing seasons. All the facts ascertained, as well as all analogy from what is known of the life-history of other species of the family, point to the accuracy of that conclusion. Yet experiments enough are on record to show, that, where the conditions of early spring and summer are artificially maintained, agamic reproduction in aphides may be greatly extended, and even go on to the third or fourth year.

Of course, this possibility of such continued agamic multiplication does not change the practical fact of what does take place in an ordinary year under ordinary seasonal changes. Balbiani, therefore, is theoretically quite right in insisting on the importance of the destruction of his winter egg. Just here, however, is where we shall have to differ from him as to the practical value of attempts to do so, and for the following reasons: —

It is a universally conceded fact, that the species hibernates chiefly in the dormant larval state underground. Now, even supposing that every so-called winter egg could be destroyed, we know positively that the vines would still be infested, and that new impregnated eggs would again occur the ensuing fall or winter. Therefore, even on Balbiani's belief, these eggs would have to be annihilated for at least two consecutive years to do any good. But, unfortunately, all methods of annihilation heretofore proposed have proved impracticable, and, in fact, impossible.[1] Decortication must always be but partially successful, as the eggs are not confined to the loose bark or to the older portions of the vines. Moreover, our researches in this country (and it seems to us that experience in Europe corroborates them) show conclusively that this impregnated egg is not necessarily a winter egg, for it is extremely rare, and difficult to discover, during winter, or at any time: hence, and for the reason that larval hibernation prevails, we are justified in one or the other of the following conclusions: —

1°. That the sexual females do not necessarily confine the impregnated egg to the stems and branches, but lay them also at the base of the vine, or even beneath the ground; 2°. That hypogean, apterous females also produce the sexed individuals underground; 3°. That the impregnated egg hatches the same season that it is laid.

Now, there are certain facts of experience that would give some warrant to all three of these conclusions, the first and second being fully justified by facts recorded by Balbiani and ourselves. The third statement we have proved true with Phylloxera Rileyi; and M. P. Graels has also proved it for P. vastatrix in Spain (see *Amer. nat.*, 1881, p. 483).

Thus we have little faith in the results of decortication; and we have already expressed much the same views in the *American naturalist*, in our eighth Missouri report, and in our report to the Department of agriculture for 1878, p. 83.

With regard to the use of American vines as stocks on which to graft the more susceptible French vines, the commission admits the success of the former in rich or deep soils, but concludes that they leave something yet to be

[1] The eggs, in the rare cases where they are found, are concealed as much as possible in minute cracks and crevices, so that mechanical decortication cannot well reach them all; while the application of heat, as by torches, would not destroy them all unless intense enough to injure the vines.

desired on light or superficial soils. It seems to us that this amounts to little more than saying that a vigorous vine cannot be grown on a poor soil; the fact being that the American vines for this particular purpose have made their way against much opposition, and remain to-day the best solution, all things considered, of the Phylloxera question.

The commission finally concluded that the prize of 300,000 francs be still reserved, but maintained. It seems to us that some disposition should be made of this prize, as the commission must not expect to get any more satisfactory means of dealing with the pest than those already proposed, that are based on experience and sound scientific principles. By this we mean that the treatment of any such underground pest that has so varied a life-history must necessarily involve a given amount of time, money, and labor, regardless of the particular substance or means employed; and to look for a 'remedy' that shall involve neither is to look for the impossible, — the miraculous. Those who were the first to suggest and prove the value of resistant American vines, those who established the value of submersion and bisulphide of carbon, and those who have helped toward a sound knowledge of the insect's life-history, — all deserve recognition.

The methods recommended by the commission for the year 1883, aside from the use of the American vines, are the old ones of submersion, bisulphide of carbon, and sulphocarbonate of potassium. C. V. RILEY.

CALIFORNIA AGRICULTURE.

University of California. College of agriculture. Report of the professor in charge to the president, being a part of the report of the regents of the university. 1882. Sacramento, *State*, 1883. 179 p. 8°.

THIS report includes the general report of the professor in charge, E. W. Hilgard, to the president, and four appendices, or special reports: viz., report and discussion of work in the agricultural laboratory, by E. W. Hilgard; report on instruction given, and culture experiments, by Charles H. Dwinelle; report of W. G. Klee, gardener in charge of the experimental grounds, on fruit and miscellaneous cultures; report of work done in the viticultural laboratory, with record and discussion of results, by F. W. Morse.

In his general report, Professor Hilgard reiterates the opinion which he has advanced in another publication (*Atlantic monthly*, April and May, 1882), that, in view of the present wide-spread indifference to agricultural education, "the work of an experiment-station . . . is the key to the situation, so far as the utility and public appreciation of the College of agriculture is concerned." In accordance with this view, work appropriate to an experiment-station has been carried on, in addition to the work of instruction, to as great an extent as the time and means at command permitted; and the four appendices to the general report contain the results of the investigations which have been made.

The work of the agricultural laboratory has consisted chiefly of an examination of the more important and widely distributed soils of the state. These are classified geographically; and chemical and mechanical analyses of several representative samples of each class have been made, from the results of which very important conclusions are drawn as to the present and prospective value and the proper treatment of these soils. Professor Hilgard is far from falling into the old erroneous belief that chemical analysis can be depended upon to show the immediate deficiencies of a soil; but he holds that it may furnish important information as to the amount and kind of reserve matters which it contains, and afford a guide to a rational method of cultivation; and in his hands it certainly seems to justify the claims made for it.

One of the most interesting portions of the horticultural report in appendix III. is that devoted to the vineyard, where are given the results of experiments on grafting the European grape (Vitis vinifera) upon a native Californian species (Vitis californica). The conclusion is reached, that "it must be considered definitely proved that the Vitis californica is well adapted as a grafting stock for a large number of the varieties of Vitis vinifera." The importance of this fact, of course, lies in the greater power of resistance to Phylloxera possessed by the American species. Experiments upon the latter point are now in progress with grafted specimens.

The account of the viticultural work includes some observations on the occurrence and development of Phylloxera, but is chiefly occupied with the results of the experiments on wine-making, which, though still incomplete, and though necessarily executed on a small scale, furnish much valuable information as to the character of the wine to be obtained from different varieties of grapes, and from grapes grown in different regions of the state. They can hardly fail, if continued, to exert a most

beneficial influence on the advance of this industry in California, and may fulfil the hopes of their authors by leading to the establishment of definite and reliable brands of California wines.

The whole report, while dealing largely with questions of local interest, affords at the same time an admirable illustration of the advantage accruing to agriculture from the application of high scientific attainments to the investigation of its problems.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Semi-diameter of the moon. — Professor H. M. Paul, formerly assistant at the U. S. naval observatory, gives the results of two occultations of the *Pleiades* group by the moon, observed by himself to determine the *occultation semi-diameter of the moon*, and also the corrections to the right ascension, declination, and parallax of the moon, these being necessarily involved with the semi-diameter. The occultations occurred on July 6, 1877, and Sept. 6, 1879, and were observed with the 9.6-inch equatorial at the Washington observatory. The relative positions adopted for the stars were those of Wolf with proper motions from comparison with Bessel, and the general proper motion of the group as given by Newcomb. The observations of 1877 were poorly placed for a determination of the correction to the semi-diameter, but those of 1879 give a much more reliable result. From the latter (fourteen in all), the resulting correction to Hansen's mean semi-diameter (15′ 83″. 47) is − 1″. 69 ± 0″. 12; and the resulting value is, therefore, *semi-diameter* = 15′ 1″. 78 ± 0″. 12. He gives also the results of Airy's determination from two hundred and ninety-six scattered observations, from 1830 to 1860. From the immersions and emersions at the dark limb, the resulting values are larger by 0″.9 and 0″.5 than those given by Paul, and, from immersions and emersions at the bright limb, Airy's results are larger by 2″.3 and 4″.4; while the probable error of a single observation and of the final result is in all cases greatly in excess of those obtained by Paul. Mr. Paul concludes that the best way to observe the actual occultation at the bright limb is to use as high a magnifying power as possible, so as to obtain a decided difference of color between the star and the moon's limb. Neither set of occultations observed by Paul gives any evidence of deviation of the moon's limb from a perfect circle. — (*Rep. Wash. obs., 1879, appendix* ii.) M. MCN. [1103

ENGINEERING.

Swelled rifle-barrels. — A board of officers, with Capt. Greer as president, has tested a lot of rifles at the Springfield armory to determine the cause of the bulging of the barrel, which occasionally occurs in practice. They find it due to the fact that the muzzle has been stopped by sand, caused by resting the muzzle in wet sand, or in dry sand after the gun has become foul from firing. This arrests the passage of the ball, so that the pressure is increased at the point of swelling. It is curious that sand produced this result where wooden plugs, driven in tightly and swelled by steam, failed to do so. — (*Ord. notes, U.S.A.*, no. 238, Feb. 1.) C. E. M. [1104

Strength of explosives. — Gen. Abbot has extended his investigations to tonite, California gun-cotton, and rackarock. The first consists of 52.5 parts of gun-cotton and 47.5 parts of barium nitrate. The second is gun-cotton pulverized, and containing 24 per cent of moisture. The dry gun-cotton analyzed 89.6 per cent insoluble trinitrocellulose and 10.4 per cent soluble gun-cotton. This is 7 per cent above the standard required by the British government. The rackarock is composed of potassium chlorate and nitrobenzol. The substances are kept separate until needed for use, when the chlorate is dipped in the liquid until it has absorbed enough of it. Gen. Abbot found the relative efficiency in a horizontal plane for tonite, as compared with dynamite No. 1, to be 0.81 for the dry compressed state, and 0.85 for the damp uncompressed state, or 0.83 as the average value. It thus stands just below gun-cotton (0.87). Rackarock gives 0.86. The California gun-cotton was found equal to the best English. In a note, he calls attention to the spontaneous decomposition of explosive gelatine into cellulose and free nitro-glycerine, with the evolution of nitrous fumes, while in store during the winter and spring. — (*Prof. papers corps eng., U.S.A.*, no. 23, add. i.) C. E. M. [1105

Composition of steel. — Professor Abel has continued his researches on steel; and his experiments with cold-rolled steel of a *particular composition* confirm the view that the carbon exists in it in the form of a carbide which has the formula Fe_3C, or some multiple of that formula. Whether this carbide varies in composition in different descriptions of steel which are in the same condition of preparation remains to be demonstrated; but the preliminary experiments with small specimens of cold-rolled, annealed, or hardened steel, appeared to warrant the belief that the condition of the carbide in the metal is affected to such an extent, by the process of hardening, as more or less completely to counteract its power to resist the decomposing effect of such an oxidizing agent as chromic-acid solution. — (*Proc. inst. mech. eng.*, Jan., 1883.) C. E. M. [1106

CHEMISTRY.

(Analytical.)

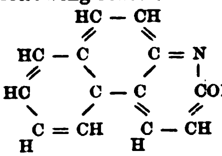
Preparation of hydric sulphide from coal-gas — When coal-gas is passed through boiling sulphur, I. Taylor finds that nearly all the hydrogen (forty to fifty per cent) is converted into hydric sulphide. He states that this is a convenient method for the preparation of hydric sulphide for laboratory use. — (*Chem. news*, xlvii. 145.) C. F. M. [1107

Hydric peroxide as a reagent in chemical analysis. — A. Classen and O. Bauer find that the great oxidizing power of hydric peroxide may be made available in many quantitative determinations which depend upon oxidation. Roth & Co. of Berlin manufacture a three or four per cent solution, acidified with hydrochloric or sulphuric acid, as may be desired. In an ammoniacal solution, hydric peroxide oxidizes hydric sulphide completely. This reaction affords a convenient and extremely accurate means for the determination of hydrochloric, hydrobromic, or hydriodic acid, in presence of hydric sulphide.

Arsenious sulphide is oxidized completely into arsenic acid and sulphuric acid. A special form of apparatus was devised by the authors for determining sulphur in sulphides. Hydric sulphide was set free by an acid, and carried forward by a current of carbonic dioxide into a tube filled with glass beads. An ammoniacal solution of hydric peroxide was allowed to drop into this tube, thereby oxidizing the hydric sulphide to sulphuric acid, which was drawn out at the bottom of the tube by means of a stop-cock. By this method accurate results were obtained in the analysis of the sulphides of antimony, tin, cadmium, iron, and of baric sulphite and hyposulphite. — (*Berichte deutsch. chem. gesellsch.*, xvi. 1061.) C. F. M. [1108

(*Organic.*)

Derivatives of chinoline. — The study of the derivatives of chinoline and their constitution is continued by several chemists. W. La Coste prepared p-nitrochinoline (1 : 6) from p-nitraniline, p-nitracetanilide, and glycerine, and p-dimethylamidochinoline from dimethylamido-p-phenylendiamine and nitrobenzol. o-nitrochinoline was made from o-nitraniline. m-nitraniline gave m-phenanthroline, identical with the product obtained by Skraup (SCIENCE, i. 283). At the same time there was formed an oxyphenanthroline whose constitution may be represented by the following reactions: —



O. Fischer prepared oxyhydroethyl- and methylchinoline by the action of the corresponding alkyl iodides on *a*-oxyhydrochinoline. In studying the therapeutic properties of the oxychinoline derivatives, it was found that oxychinoline possessed poisonous properties, and that the chlorides of the corresponding hydro-compounds exerted an action similar to that of chinine. β-oxychinoline and certain of its derivatives were examined by C. Riemerschmied. L. Hoffman and W. Königs prepared tetrahydrochinoline by reduction of chinoline with tin and hydrochloric acid. By the action of nitrous acid this substance gave a nitroso-amine ($C_9H_{10}N{-}NO$) which formed nitronitrosotetrahydrochinoline

$$\left(C_9H_9 \begin{matrix} \diagup NO_2 \\ \diagdown N-NO \end{matrix}\right)$$

when treated with nitric acid. The corresponding hydrazine was obtained by reduction. Indol was one of the products of the dry distillation of tetrahydrochinoline. — (*Berichte deutsch. chem. gesellsch.*, xvi. 669, 721, 727.) C. F. M. [1109

AGRICULTURE.

Digestibility of moistened and cooked fodder. — In continuation of earlier researches on this point, G. Kühn has compared the digestibility of three samples of hay and three samples of wheat-bran, when fed dry, to that of the same fodders variously treated. Moistening the hay or bran immediately before feeding with a quantity of cold water insufficient to satisfy the thirst of the animals (steers) had no recognizable effect on the digestibility. Moistening the bran with cold water twenty-four hours before feeding had no effect on its digestibility, provided the quantity of water was so limited that the amount drunk by the animals did not fall below about fifty per cent of that drunk when the ration was given dry. When the amount of water used to moisten the bran largely exceeded the limit just mentioned, indications of a decreased digestibility of the crude proteine of the total ration were observed. Treating the bran with boiling water twenty-four hours before feeding caused an undoubted decrease in the digestibility of its crude proteine, which was greater the higher the initial temperature, and the longer the action of the heat continued. The other constituents of the bran were unaffected. Giving the bran stirred into water as drink, along with dry hay, had no noticeable effect on the digestibility of the total ration, compared with that observed when similarly prepared bran was mixed with the hay. The experiments gave also the interesting and important result, that the extent to which the same fodder is digested by the same animal may vary at different times. A new source of error in digestion experiments is thus brought to light, and one which must receive serious consideration in all future experiments, and lead to new caution in accepting the results of old ones, especially in the case of concentrated fodders, since the calculation of the digestibility of the latter is based on the assumption of unaltered digestibility of a coarse fodder for two consecutive periods. These experiments are worthy of notice also for the care and conscientiousness with which the limits of possible error are taken account of in the discussion of the results. They afford, in this respect, an excellent example of really scientific investigation, and contrast favorably in this particular with many agricultural experiments. — (*Landw. vers.-stat.*, xxix. 1.) H. P. A. [1110

Bottled milk. — Milk preserved by Scherff's process (heating in closed bottles to 100°–120° C. for one or two hours) differs from fresh milk in certain respects. It is not coagulated by rennet, and when acidified, or allowed to become sour, it yields a fine, granular coagulum. These differences have been attributed to chemical changes in the albuminoids of the milk, produced by the heat; but Fleischman and Morgen fail to find in such bottled milk any peptones or other products of the decomposition of proteids, or any evidence of a chemical alteration. It appears to be a trifle less readily acted on by pepsin than fresh milk. The good results obtained by its use for sick children are ascribed to the granular coagulum which it yields in the stomach, and its freedom from all germs. — (*Landw. vers.-stat.*, xxviii. 321.) H. P. A. [1111

Soil-temperatures. — In continuation of previous researches, E. and H. Becquerel have taken the temperature of two soils at different depths twice daily during the year 1882. One soil was naked, and the other covered with turf.

At a depth of 0.05 m., the turfed soil was the warmer at 6 A.M. At 3 P.M. the naked (sandy) soil was the warmer during the warm months, while during the cold months the reverse was the case: in other words, the range of temperature was less under the turf. At greater depths this effect became less marked, and on the average the turfed soil was 0.1°–0.7° warmer than the naked one. — (*Comptes rendus*, xcvi. 1107.) H. P. A. [1112

Reduction of nitrates. — The reduction of nitrates by means of an organized ferment, which has been observed by Springer (SCIENCE, i. p. 115), has also been the subject of experiments by Gayon and Dupetit, Dehérain and Maquenne, and de Rodionoff. The action of the ferment is prevented by oxygen and by disinfectants, and heat destroys the ferment. Large quantities of free nitrogen are produced in

the fermentation, and smaller quantities of ammonia, nitrous oxide, nitric oxide, nitrites, and probably amide-like bodies, were obtained. The action has been shown to take place in soils rich in organic matter, when excluded from the air; and a small quantity of active soil may infect a large amount of soil which has been sterilized by heat. — (*Bied. centr.-blatt*, 1883, 82.) H. P. A. [1113

Butt and tip kernels of corn. — In a number of sprouting trials at the Ohio agricultural experiment-station, corn taken from the butts of the ears produced larger and stronger radicles than that from the tips, while that from the middle of the ear was intermediate in this respect. The proportion of seeds which sprouted was: tip kernels, 70.3 %; middle kernels, 58.2 %; butt kernels, 76.1 %. — (*Country gentleman*, May 10.) H. P. A. [1114

GEOLOGY.

The Balkan peninsula. — In the tenth number of *Petermann's mittheilungen* for 1882, Toula published a geological map of this region, which gives us a better idea of the geology of that much-disputed country than any thing yet published. By a mistake, the region between Aïwadschik and Köprüköï, in Bulgaria, was colored as Jurassic instead of eocene. With this exception, this map, in sixteen colors, is fully up to Petermann's usual standard. Toula now publishes a map on the scale of 1: 2,500,000, on which, by means of twenty-five different lines, he shows the routes travelled over by different geological explorers in this region from the days of Herder, Boué, and Viquesnel (1835–37), down to the present time, and in the accompanying ten pages of text gives a brief account of the country visited, and a historical sketch of the work done by each author. — (*Mitth. geogr. gesellsch. Wien*, 1883, 25.) J. B. M. [1115

Origin of the carboniferous limestone of Belgium. — Dupont divides the carboniferous limestone of Belgium into massive and stratified limestones, the latter essentially detrital rocks with a sedimentary appearance. The massive limestones are due to the growth of corals, and are adapted to the special dispositions of coral formations in fringing reefs or islets, according to their distance from the shore. The detrital limestones are subdivided into two marked categories: the crinoidal limestone; and the limestone made up of coralline detritus, with or without interstratified beds of crinoidal limestone.

These three divisions correspond with the three faunas that de Koninck has distinguished, — the fauna of Tournai, belonging to the crinoidal limestone; the fauna of Waulsort, to the coral-reef limestones; and the fauna of Visé, to the detrital limestones. The stratigraphical study of the Belgian carboniferous limestone thus becomes much simplified; and the problems suggested by the mixture of rocks of the same chemical composition, but of different modes of formation, can be solved by studying the mode of formation, and the application of the stratigraphical laws of coral phenomena established by the study of the Devonian limestones. — (*Bull. acad. roy. Belg.*, (3), v. no. 2.) J. B. M. [1116

PHYSICAL GEOGRAPHY.

Causes of the fertility of land in the Canadian north-west territories. — Robert Bell showed, that, with local exceptions, a vast fertile tract stretches from the Red River valley to the Liard River, a distance of some fourteen hundred miles, characterized by a dark loamy soil of varying depth and nearly homogeneous consistency. The primary cause of the fertility of this region may be found in the character of the subsoil, which consists largely of cretaceous marls and the comminuted material of the glacial drift. The speaker ascribed to moles and other burrowing animals the chief agency in the process by which the black loamy soil was formed out of this subsoil. Darwin had proved that in England and some other countries earth-worms played the chief part in the formation of mould. These worms appear to be absent in the north-west, as well as in most cold and sparsely settled countries, perhaps due to the depth to which frost penetrates. But in the north-west he believed the ground squirrels and moles more than made up for the absence of worms. In the fertile area referred to, the old and new mole-hills cover the entire surface, rendering it 'hummocky,' as is easily observed after a prairie fire. These animals are very active in autumn, digging many more burrows than would appear to be of any use to them. Each hummock thus thrown up covers about a square foot, and buries all the grass, etc., on this space. In this manner large quantities of vegetable matter were ultimately incorporated with the soil, which was also refined by the fact that the stones and coarse gravel are left undisturbed below the surface, so that in time they are more deeply buried by the layer of mould produced. By an interesting coincidence at the season when these burrowing animals are most active, the prairie vegetation is mature, and contains the greatest amount of substance. The coldness of the soil during a great part of the year tends to preserve the organic matter in it. While the circumstances given were the direct cause of the fertility, the ultimate reason was perhaps to be looked for in the climate, which fosters the growth of such vegetation as forms both the fertilizing material and the food of the little workers, who mingle it with the mineral portion of the soil. The action of frost in comminuting the soil does not account, by itself, for the introduction of the organic matter upon which its fertility depends, and which is due to the co-operation of the circumstances and agencies described. — (*Royal soc. Canada; meeting* May 23.) [1117

The French 'Landes.' — E. Blanc describes the great improvement effected in the formerly desert region of south-western France by planting its sandy surface with the maritime pine (Pinus pinaster). The region is divided according to its surface-features into five districts, locally named the Grande-Lande, the Dunes, the Marensin, the Maremme, and the Chalosse. The first includes half the entire area, and, before the tree-planting, was an open plain of loose sandy soil about two feet deep, lying on an impermeable layer (*alios*) of sandstone cemented by organic and ferruginous material. During winter it was a great marsh; in summer, a dry, sandy desert, barely supporting its flocks of sheep. The absence of stone for building and road-making was another cause of its poverty. Since 1857, nearly the whole surface has been covered with a continuous pine forest, from which the resin is a valuable product. The stilts of the old shepherds are no longer the fashion. The Dunes, extending along the coast of Gascony from the Adour to the Gironde, form a belt four to eight kilometres wide. Their sand does not come from the coasts of Spain and Brittany, as has been supposed, but from a submerged continuation of the Landes. Their height sometimes reaches eighty metres. These, also, were formerly barren: they are now almost entirely wooded over. Their area of 88,096 hectares (nearly 350 □ miles) contained 15,82

hectares of forest in 1840. and 55,584 in 1862, the unplanted part being chiefly the little valleys (lettes) between the Dunes. From 1861 to 1865 the greater part of the forests on the Dunes was sold by the government for a total of 13,000,000 francs; but, as the supply of resin from our southern states was just then diminished by the war of the rebellion, the pines were much injured by bad treatment from their private owners. The Marensin is a region of old forests included in the district of lagoons between the southern quarter of the Dunes and the Grandes-Landes as far south as Dax. It has long produced a valuable yield of resin, and is thought to have had harbors and ports in Roman times; but these have long since been destroyed by the drifting sands. The Maremme comes next farther south along the coast. It is a region of large dunes of irregular form, independent of the present coast, and probably much older than the sand-hills farther north, occupied by an old forest of cork-oaks and resin-pines. The Chalosse is the only agricultural part of the Landes. It extends southward of the Adour to the department of Basses Pyrénées, — a rolling, well-watered, fertile country. After this introductory description, M. Blanc discusses the future of the region, and its improvement by further tree-planting, and by opening a canal to connect all its lagoons behind the Dunes. — (*Rev. scient.*, 1883, 391.) W. M. D. [1118

METEOROLOGY.

Rainfall in South Australia. — The tropical rains on the north coast prevail during the summer months, commencing generally towards the end of October or beginning of November, and lasting until April, little or none falling during the intermediate months. These tropical rains extend more or less across the interior, down to, or even south of the Peake (lat. 28°), but fall off considerably south of the Daly Waters (lat. 16° 15′). This, however, varies greatly in different years, according to the force and southerly dip of the north-west monsoon. In some cases, heavy thunder-storms and torrential rain extend over nearly the whole of the interior, and in other years the rainfall is heavy for only a few hundred miles from the north coast; and the country, especially south of the tropics, down even to the head of Spencer's Gulf, is exposed to long and severe drought. On the other hand, the winter rains occasionally extend well up into the interior, sometimes reaching or passing the centre of the continent. This, perhaps, is more especially the case when the centre of a cyclonic disturbance passes to the north of Adelaide, from west to east, and also when cyclonic disturbances in Queensland, or on the east coast, have their western quadrant extending well into the central regions of the continent and the northern pastoral districts of South Australia. But most of our disturbances have their centre south of the continent, their path being roughly parallel to the coast-line, so that as a rule our winter rains thin off, and become uncertain about a hundred miles north of the head of Spencer's Gulf, and are heavy north of the Gulf only along or near the Flinders Range. The area of minimum rainfall extends from the Great Australian Bight to Port Augusta, at the head of Spencer's Gulf; northwards up Lake Torrens and Lake Eyre; and again over the plains to the east of the Flinders Range, up to about lat. 25°, reaching on either side to within, perhaps, a few hundred miles of the east and west coasts (especially the latter). All south of this, and for some distance northwards, along and in the immediate neighborhood of the Flinders Range, we usually have good winter rains, but uncertain summer rains; the latter being heavier and more frequent over the northern limits of this region, where they bear a large ratio to the total fall during the year. — (*Met. obs. Adelaide observ.*, 1880.) [1119

Rainfall in France. — At the last meeting of the Meteorological society of France, a paper was read by Mr. Moureaux, showing that the law of the rains south of the central plateau of France is independent of the meteorological conditions on the oceanic side. This shows the importance of being in direct connection with Algiers. — (*Nature*, March 22.) H. A. H. [1120

GEOGRAPHY.

(Arctic.)

Arctic notes. — In the year-book of the Verein für vaterländishe naturkundé in Württemberg, Zeller has an article on the Algae and zoophytes of the Nordenskiöld Sea, collected by Graf Waldburg-Zeil. —— *Nature* (vol. xxviii. no. 3) gives a woodcut of the Russian meteorological station at the Lena mouth. —— The Leo is announced to sail for Point Barrow, June 12, from San Francisco. —— The steamer Proteus is to go to the relief of the Lady Franklin Bay party, and is expected to sail about the 20th inst., or as soon as she can be joined by U.S.S. Yantic, which is to act as tender, and to utilize as far as possible the scientific opportunities of the voyage. — W. H. D. [1121

(Africa.)

African notes. — In spite of the disastrous ending of the Flatter's expedition, two more parties are planned by the French for Saharan exploration, under Col. Bernard and F. Foureau. According to a recent despatch from Wargla, four members of Flatter's party are still alive as prisoners among the Tuaregs. —— In western Africa the active French advance has met with opposition. Dr. Bayol was refused permission to continue on his way to Kaarta, and has returned to Bafulabe on the Senegal. Col. Berguis-Desbordes writes from the upper Niger, that, after his losses on the way there, he must at once return to the coast unless immediately re-enforced. A sketch of the rapid progress of the French in this region is given by J. Ancelle in *Rev. de géogr.*, 1883, 161-183. —— R. Flegel writes from Lagos under date of March 20, 1883, of his safe return from Adamaua and the source of the Benue; his farther journey was cut short by lack of means. —— The International Kongo association has despatched Lieut. v. Kerkhoven from England with supplies for the parties in the field. It is stated that he takes a number of carrier-pigeons with which to keep up communication from the interior with Zanzibar; but this must be a mistake. A general review and map of the later explorations in the Kongo basin is given in *Peterm. mitth.*, 1883, 177. —— News has been received from Dr. Pogge at Mukenge, on his way to the west coast, after parting from Lieut. Wissmann in the farther interior. —— Dr. Holub is about to start for southern Africa after a course of special geographic study; he proposes to go northward from the Cape to the lake district. —— Giraud and Thomson, recently entering Africa from Zanzibar, have been heard from in good condition, a short way on their respective journeys. —— Revoil has left Somali-land for the Zanzibar region. —— The French and Italian exploration about Shoa and Assab is still very active in spite of the unattractive climate of these districts. At Assab nearly all the drinking-water has to be distilled from the sea. —— Schuver, the Dutch explorer, arrived in Kartum last December, and Dr. Junker is expected there shortly from his journeys in the far

interior. —— Dr. Colin of the French navy has been charged with a mission to the Senegal; his instructions are to search for gold, to obtain concessions of the auriferous regions from the local chiefs, or at least protection for those who may go there, and to make geographic and scientific observations as far as possible. He expects to return to France next April. — W. M. D. [1122

(Indian Ocean.)

Heard Island. — The U.S. S. Marion, Commander Terry, last year went to this seldom-visited island in the southern Indian Ocean (lat. 53° 20′ S., long. 73° 10′ E.) to search for the crew of the whaler Trinity, not heard from for eighteen months. The rescue was successful; and on Jan. 13, 1882, the men were taken from the island after over a year's endurance of excessive hardships. Ensign Chambers gives an interesting account of the expedition. The island was discovered in 1853 by an American, Capt. Heard, who believed it to be afloat, as he 'had sailed over its position repeatedly on former voyages;' but its firm anchorage is pretty well established by the presence of an active volcano, about six thousand feet high, seen in moderate eruption by the crew of the Trinity; and its antiquity is proved by marks of former glacial action which date somewhat before Capt. Heard's voyages. The climate of the island is extremely severe. Snow-squalls were of daily occurrence even in midsummer, and the air was seldom clear enough to show the mountain summit. Sea-currents pass the island from north to south. It is supposed from the appearance of clouds, and from the flight of birds and departure of sea-elephants, that an uncharted island must lie sixty or one hundred miles south of Heard; and it is even said that a certain sealing-captain has discovered an island in that direction, the position of which he keeps a secret in the interest of his trade. — (*Proc. U. S. naval inst.*, ix. 1883, 121.) W. M. D. [1123

Indian Ocean. — On his return from Japan in April–May, 1881, G. Liebscher took samples of the water in the Bay of Bengal (about lat. 5° N.) and Arabian Sea (near lat. 15° N.), finding the specific gravity of the former at 60° F., 1.0255 to 1.0258, and its percentage of salt 3.29 to 3.34; for the latter, 1.0264 to 1.0276, and 3.40 to 3.52. — (*Mitth. erdk. Halle*, 1882, 139.) W. M. D. [1124

BOTANY.

Cryptogams.

Diseases of the vine. — The Observations sur le Phylloxera et sur les parasitaires de la vigne, published under the direction of the French academy, contains a long and valuable paper by Cornu on Peronospora viticola B. and C., which has within a few years been introduced into the vineyards of Europe from this country. After an elaborate statement of the history of the discovery of the Peronospora and its spread to Europe, there follows a full account of the development and pathological action of the fungus, beautifully illustrated. The work concludes with an account of the treatment and prevention of the disease, and a comparison of the grape-mould with those of the potato and lettuce plants. — W. G. F. [1125

Glycogen in fungi. — In a thesis entitled 'l'Épiplasme des Ascomycetes,' Dr. Léo Errera demonstrates, that apart from the Myxomycetes, whose vegetable nature is not beyond question, glycogen occurs in undoubted plants, especially in the Ascomycetes, an order of fungi. It also appears to exist in the yeast-plant and Pilobolus, a small mould. The glycogen of Peziza vesiculosa is identical with that found in the livers of mammalia. In the Ascomycetes, it is at first diffused throughout the whole young plant, but afterwards accumulates in the asci, and is apparently transformed during the maturing of the spores. When not in too small quantities, glycogen may be recognized microchemically by its semi-fluid consistency, the absence of any reaction with osmic acid, Millon's reagent, and iron salts, and by the reddish-brown or mahogany color on the application of iodine, which color disappears on heating, and reappears on cooling. — W. G. F. [1126

Spores and spore-cases in Erian rocks. — Dr. J. W. Dawson spoke of the discovery many years since, by the geological survey of Canada, in a pyroschist or bituminous shale at Kettle Point on Lake Huron, — referred to the horizon of the Marcellus beds of the New-York series, — of vast numbers of minute disks, which were recognized as the spore-cases of some cryptogamous plant, and were by him named Sporangites huronensis. More recently Profs. Orton of Columbus, O., Williams of Cornell university, and Clarke of Northampton, Mass., have found, in the Erian (Devonian) and lower carboniferous shales of Ohio and New York, beds replete with these organisms; and Prof. Orton has shown reasons for believing that they are connected with filamentous stems found in the same layers, and, moreover, that they have contributed largely to the bituminous matter present in the shales in which they occur. Similar bodies have also been found associated with the curious plants known as Psilophyton and Trochophyllum. Still more recently specimens from the Erian of Brazil have been sent to the author by Mr. Derby of the Brazilian geological survey, which seem to throw additional light on the bodies in question. These specimens present oval or rounded bodies in the form of flattened sacs, containing numbers of rounded disks similar to those above referred to, and so closely resembling the utricles, or spore-sacs, of the rhizocarps as to make it extremely probable that they belonged to plants of this class. Should this conjecture be sustained by subsequent inquiries, it would show that this peculiar group is of much greater antiquity than hitherto supposed, and that these plants were extremely abundant in the shallow waters of the Erian period. Dr. Dawson further suggested probable relations of these singular fruits not only with Psilophyton, but also with other Erian and Silurian plants. — (*Royal soc. Canada: meeting* May 23.) [1127

ZOÖLOGY.

Mollusks.

Land-snails from Bering Strait and Alaska. — Drs. Aurel Krause and Reinhardt enumerate and describe the land-snails obtained by the Krause brothers in the Chukchi peninsula and in south-eastern Alaska. Seven species were obtained from the former locality, and nineteen in the latter. Most of them are common to both shores. As a matter of much interest to American conchologists, the species new to the fauna of the United States, as determined by them, may be mentioned. Omitting mere varieties, these are: Limax hyperboreus West., Conulus pupula Gould (originally described from Japan), Pupa Gredleri Cless., P. Krausiana Reinh., P. arctica Wall., Succinea chrysis West., Vallonia asiatica Neville (Yarkand, described by Neville as a variety of V. costata), and Pupa edentula Drap. (probably). Dr. Reinhardt also describes, under the name of Vallonia gracilicosta, a small shell obtained by Krause on the Little Missouri River, while

returning home by the route of the Northern Pacific railway (*Sitz. Berl. ges. naturf. fr.*, 3, 1883). In the same connection, the following species of the Vega expedition are of interest for American students. Westerlund, in advance of the final publication, describes as new, from the same region, Helix ruderata var. opulens, collected at Bering Island; Succinea annexa and chrysis; and Pisidium arcticum, nivale, and glaciale, from Port Clarence, Alaska. — (*Nachr. deutsch. mal. ges.*, April, 1883.) W. H. D. [1128

A man-eating mollusk. — A minute pulmonate, Cionella acicula, was not long since reported as occurring in myriads in the cavities of cancellate bones in a prehistoric British cemetery at Chichester. It has now been found of unusual size, by Director Fischer, in human skulls from comparatively recent interments at Bernberg. — (*Nachr. deutsch. mal. ges.*, April, 1883.) W. H. D. [1129

Monograph of Onchidium. — The last-received part of Semper's land-mollusks of the Philippines contains the continuation of an extremely thorough monograph of Onchidium, — the genus of slugs in which that author made the discovery of the extraordinary 'dorsal eyes,' and which seems to be prolific in species in the east. The new genus Onchidina is established for O. australis Gray, which exhibits marked anomalies in the genitalia. — (*Semper's reisen.*, heft iv.) W. H. D. [1130

VERTEBRATES.

Centripetal stimulation of the vagus. — In a previous paper (*Wiener sitzungsb.*, lxxxv., 282), Knoll had pointed out that the vagus nerve may be stimulated by the making or breaking of its own current, when the nerve, for instance, is raised from the moist tissue upon which it lies, or, after being raised, is again lowered into the wound. This is especially the case after exposure, or section, or other mechanical injury. The effect of such a stimulation is, in the great majority of cases, the production of an expiratory standstill, or a flattening of the respiratory curve toward the expiratory position. In many cases the action is not confined to a mere inhibition of the inspiratory discharge, but causes an active expiratory effort. In this, his second contribution to the theory of the innervation of the breathing movements, he submits the action of electrical, mechanical, chemical, and thermal stimuli upon the central end of the vagus to a new investigation, taking care to avoid any secondary effects arising from stimulation of the nerve by its own current. The experiments were made upon rabbits, to some of which a minimal dose of chloral was given. The effect of induction shocks was found to vary with the strength of current used, minimal currents causing a short expiratory pause, or a displacement of the curve toward the expiratory position; stronger currents giving inspiratory effects. During the period of vagus stimulation, although there is always a certain amount of dyspnoea, nevertheless the accessory respiratory muscles do not come into action, and, if previously in action, become relaxed during the stimulation. Neither anaemia of the brain, caused by blocking off the blood-current, nor respiratory reflexes from other afferent nerves, stimulation of the nasal mucous membrane, for instance, produce any breathing movements during the inspiratory standstill which follows strong electrical stimulation of the vagus. From these facts he concludes, that, during such stimulation of the vagus, the irritability of the respiratory centre toward other stimuli, especially natural stimuli, is greatly depressed. He finds that the effects obtained may differ according to the direction of the current, the portion of the nerve stimulated, the condition of the nerve and of the respiratory centre, — conditions which may explain the contradictory results obtained by those who have worked at the subject. Mechanical stimuli produced in various ways gave always, as the primary effect, either complete standstill in inspiration, or strong displacement of the curve toward the inspiratory position. Chemical stimuli inhibited respiration in the expiratory phase. Thermal stimuli had apparently no effect. Warming the vagus in 0.6 % salt solution or oil from 1½°-2° to 45°-60° C. had no action on the respiration. — (*Wiener sitzungsb.*, lxxxvi., iii. 48.) W. H. H. [1131

Activity of the yolk during impregnation. — Kupffer recalls the active movement of a protoplasmatic hillock on the surface of the ovum of Petromyzon, observed by August Müller, Calberla, and himself, immediately after the spermatozoon entered the yolk. He now reports a similar observation on Bufo. In this animal several spermatozoa enter the ovum; but those that reach the egg a few minutes after spawning are not able to pierce the egg-membrane. One then sees little protuberances arise on the surface of the yolk, and stretch up the membrane. Opposite each protuberance are one or two spermatozoa, their heads towards the yolk. It appears as if the yolk were actively striving to reach the spermatozoa. In a few minutes the protuberances sink back. In both Bufo and Petromyzon there appears this secondary act of impregnation after the male elements (or element) have penetrated the yolk. — (*Sitzungsb. akad. wiss. München*, 1882, 608.) C. S. M. [1132

ANTHROPOLOGY.

Growth of the skull in dogs. — M. Lacassagne having communicated to the biological society of Lyons a paper on the cranial dimensions in man in their relation to social condition and intellectual culture, Dr. Arloing has followed up the subject upon dogs. Discarding the merely instinctive faculty, attention was paid only to the intellectual. The subject of weight and race was so far considered as to render it easy to make allowance for these, since the average weight of the well-known breeds is known everywhere. The following table tells its own story: —

	Weight of the skull.	Weight of brain.
	Grams.	Grams.
St. Bernard	100.39	387
Large spaniel (Grand epagneul). . .	85.5	695
Bull, medium size	81.14	205
Bull, small size	58.2	110
Little spaniel	50.7	67
Loulou	53.9	62
Havana	73.6	60
King Charles	50.7	45

The brain of a small ape weighs from seventy to seventy-five grams. We see from the table that the weight of the head is doubled, while the weight of the brain is eight times greater, between the extremities of the table. The difference would be much greater if we could compare the weight of the brain with that of the body. The conclusion reached is, that education increases the dimensions of the skull in animals as in man. — (*Bull. soc. anthrop. Lyon*, i. 44.) J. W. P. [1133

Criminality in France. — "Society, in its moral and social aspect," says M. Lacassagne, "is divided into three strata, — the frontal, the parietal, and the occipital; the latter including the most of our race." The causes which operate upon the human organism are cosmic and social; or, as M. Lacassagne has it, physico-chemic, biologic, and social. The first includes temperature, physical forces, aliment, etc., acting, first, upon the posterior part of the brain, thence forward, influencing the instinct to control the intelligence. The second includes sex, age, heredity, temperament, acting equally on all parts of the brain, and giving to the sentiments, thoughts, and acts a characteristic peculiarity. The last, acting from the front brain backwards, modifies the ideas before changing the sentiments.

The penal code of France divides infractions of the laws against persons and property into contraventions, délits, and crimes; and, for seeking out and punishing these, an army of two hundred thousand individuals is engaged, costing 41,694,720 francs, against 26,034,016 for primary public instruction.

M. Lacassagne, after reviewing the works of Quetelet, Guerry, Maury, and Ferri, on the statistics and philosophy of crime, proceeds to furnish, in a series of curves, the results of his own researches. It is well observed, that, in studying a series of years, notice must be taken of the changes in the law and the multiplication of recognized infractions. Crimes against property vary with the price of breadstuffs, the operation of tariff, warm summers, rigorous winters. Crimes against persons are shown to be influenced by revolutions, elections, the wine-crop, etc.

The relation of crime to the season of the year presents some interesting facts, the table showing a criminal calendar in which the maxima of crimes against property are placed opposite to the minima of crimes against persons. The former have their maximum in December, their minimum in April and June. The latter have their minimum in November, and their maximum in June. Each crime is then scrutinized by months, according to the causes affecting it, such as heat and cold, wine-production, harvests, forced indoor life in winter, wandering life in summer, the length of the day and night, fêtes, holy days, pay-days, reaping-time, vintage-time, salaries to domestics etc. For instance, infanticide is large in January, February, March, and April, as the effect of the aphrodisiac months, while abortions, usually at the fifth month, are numerous in January; conceptions of harvest-time, at their maximum in March; conceptions of the new-wine season, high in May; conceptions of Christmas holidays, high in June; conceptions of the carnival, ascending in September, October, November, and December, owing to the aphrodisiac months.

Assassination, murder, parricide, poisoning, theft, are similarly treated, and the relation of crime to sex and illiteracy examined. M. Lacassagne closes his discussion with observations on the prevention of crime. — (*Bull. soc. anthrop. Lyon*, i. 48–71.) J. W. P. [1134

EARLY INSTITUTIONS.

Writing among the Romans. — M. Havet points out the curious fact, that Greece had a literature before she had the means of recording it, while Rome had the means before she had the literature. It is certain that in Greece literature existed at first independently of writing; but in Rome writing was in use during the period of the kings, when there was no literature. This fact being established, M. Havet asks whether writing was introduced during the time of the kings, or before that time, i.e., before the foundation of Rome. He then goes on to show how the Romans must have used writing before they came into contact with the Etruscans, because they did not adopt the Etruscan alphabet. Writing must have been in use, he concludes, in the earliest period of the history of Rome, if not before the foundation of the city. Then he argues, if this is the case, what right have we to suppose that the early kings are fabulous? If they knew how to write, it is probable that they put their names in writing. The question is raised, What did the Romans do with their writing, if they did not use it to record events which actually happened? They had no literature to give it a *raison d'être*. The argument is an interesting one. — (*Rev. polit. et lit.*, 24 Mars, 1883.) D. W. R. [1135

Beginnings of taxation in France. — M. Vuitry continues his studies in the financial history of France, and describes the origin and establishment of state taxes as distinguished from the revenues of a feudal sovereign. These, he tells us, must not be regarded as state taxes. He defines state taxes as taxes levied upon all citizens for the purpose of defraying public expenses. During the early feudal period there were no public expenses: therefore there were no state taxes. The expenditures of the feudal sovereign were private expenditures; his revenues were private revenues, derived chiefly from his estates, or from privileges attached to his person. It was not until the fourteenth century (1328–55) that state taxes, properly so called, were instituted. M. Vuitry explains how this came to pass. — (*Séan. trav. de l'acad.*, Avril–Mai, 1883.) D. W. R. [1136

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Bureau of ethnology.

Note on certain Maya and Mexican manuscripts. — Professor Cyrus Thomas has recently prepared a paper for the bureau, on a plate of the *Codex Cortesianus*, reproduced in plates 9 and 10 of Rosny's *Les documents de l'antiquité Américaine*, and plate 44 of the *Fejervary Codex* (Kingsborough, vol. iii.). For the benefit of scholars devoting attention to these manuscripts, a brief *résumé* of his explanation of one discovery that he has made in regard to them is here given. As facsimile plates cannot be introduced here, plans of the portions referred to are figured on the assumption that those particularly interested have access to the works in which the plates are to be found.

Mr. Thomas maintains, with a strong array of evidence, that these plates are simply a kind of condensed calendar, and that the outer looped line of dots and day-symbols in each is a mere table by which to tell the days on which the weeks (of thirteen days) for the entire year begin.

If we examine carefully the rows of large dots, and the day-symbols in the large outer space of the Cortesian plate, as given by Rosny, we shall find, that, taken together, they form but *one continuous line*,

making one outward and two inward bends or loops at each corner, as shown in fig. 1.

In this figure the dots correspond with those in the plate; the circle, with the day-symbols. The numbers

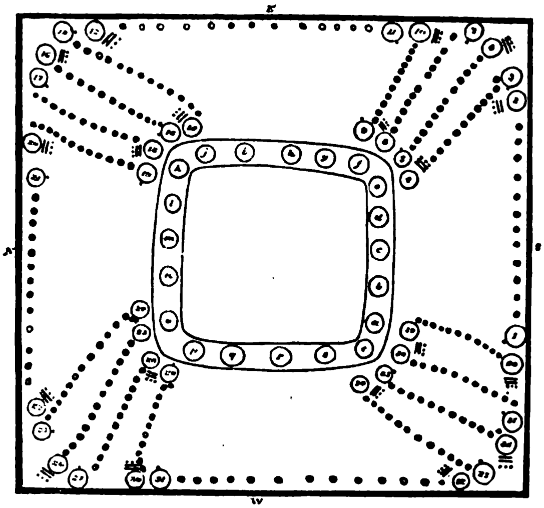


FIG. 1.—SCHEME OF THE CORTESIAN PLATE.

correspond with the numbers in the following list, in which the names are given, as shown by the symbols; those obliterated in the original are in Italics.

1 Cauac.	15 Oc.	28 Ahau.
2 Chuen.	16 *Ik.*	29 Ymix.
3 Eb.	17 *Akbal.*	30 Ben.
4 Kan.	18 *Men.*	31 Ix.
5 Chicchan.	19 Cib.	32 Cimi.
6 Caban.	20 Lamat.	33 Manik.
7 Ezanab.	21 Muluc.	34 Cauac.
8 Oc.	22 Ymix.	35 Ahau.
9 Chuen.	23 Ik.	36 Eb.
10 Akbal.	24 Ix.	37 Ben.
11 Kan.	25 Men.	38 Chicchan.
12 Cib.	26 Manik.	39 Cimi.
13 *Caban.*	27 Lamat.	40 Eznab.
14 Muluc.		

Starting with 1 Cauac (No. 1) on the right side, and running upward toward the top, along the row of dots next the right-hand margin, we reach 13 Chuen (No. 2). Just above this is 1 Eb (No. 3). Running inward toward the centre, along the row of dots, we reach 13 Kan (No. 4). Then passing upward, we come to 1 Chicchan (No. 5); then outward along the row of dots, toward the outer corner, to 13 Caban (No. 6); thence to the left to 1 Ezanab (No. 7); then inward to 13 Oc (No. 8); then to the left to 1 Chuen (No. 9); then outward to 13 Akbal (No. 10); and so on around toward the left.

The number of the day is usually indicated by a numeral symbol,—one dot for 1, and two short lines and three dots for 13.

By commencing with *Cauac*, and writing the twenty Maya days in succession, repeating them in the same order, numbering them from 1 to 13, and 1 to 13 again, or by referring to table V. of Professor Thomas's *Study of the manuscript Troano* (fig. 11), the reader will find that the days numbered 1 of the looped line (as 1 Cauac, 1 Eb, etc.) are always the first days of the Maya week, and those numbered 13 (as 13 Chuen, 13 Kan, etc.) are always the last days of the week.

The Cauac years alone have been referred to; but this calendar is made to answer equally as well for the Kan, Muluc, and Ix years. For the Kan years we begin with 1 Kan (No. 11) in the top row; for the Muluc years, with 1 Muluc (No. 21) in the row next to the left margin; and, for the Ix year, with 1 Ix (No. 31) in the bottom row.

The proof of Professor Thomas's interpretation of this part of the 'Cortesian plate' seems to be conclusive.

The signification of plate 44 of the Fejervary Codex he claims to be substantially the same as the other; and that the outer looped line shown in our fig. 2 is constructed on precisely the same plan, and for the same purpose; the only difference being, that here only the first day of the week is given, and that the days are Mexican instead of Maya.

The twenty circles at the corners and loops containing numbers indicate and replace Mexican day-symbols, as shown in the following list:—

1 Cipactli.	8 Malinalli.	15 *Calli.*
2 Ocelotl.	9 Coatl.	16 Cozcaquauhtli.
3 Mazatl.	10 Tecpatl.	17 Atl.
4 Xochitl.	11 Ozomatli.	18 Ehecatl.
5 *Acatl.*	12 Cuetzpalin.	19 Quauhtli.
6 Miquiztli.	13 Ollin.	20 *Tochtli.*
7 Quiahuitl.	14 Itzcuintli.	

The four in the larger circle, italicized in the list, are the four year-bearers or year-names.

By making a list of Mexican days in succession, beginning with Cipactli, and numbering from 1 to 13 as before, and following the line in the order

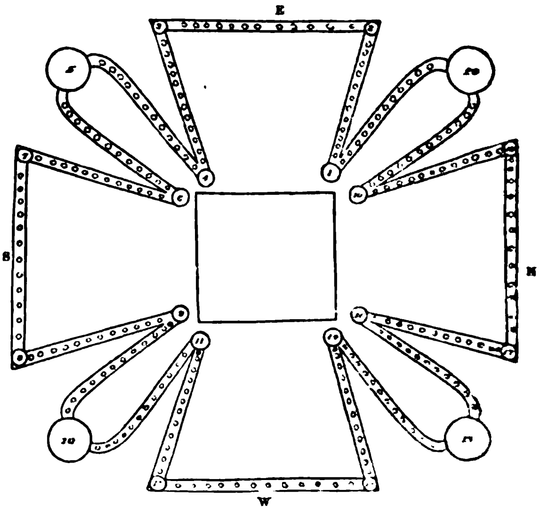


FIG. 2.—SCHEME OF THE FEJERVARY PLATE.

of numbering, as shown in fig. 2 (around to the left), we find that each day is the first of a Mexican week.

Mr. Thomas also gives interpretations of the outer parts, but these are too long and intricate to be given in this brief article.

NOTES AND NEWS.

Professor Charles A. Young writes from Princeton, N.J., June 13, "I have received from Professor Holden the following telegram, announcing the success of the eclipse expedition:" —

SAN FRANCISCO, Cal., June 11.

American eclipse expedition arrived at San Francisco, June 11. Holden reports no Vulcan as bright as 5½ magnitude. Hastings's observations prove the corona to be largely a phenomenon of diffraction by the great change in length of 1474 line on east and west sides of sun. No black lines in corona spectrum but D. Full observations with grating spectroscope, prismatic telescope, and integrating spectroscope, by Rockwell, Upton, and Brown. Contacts by Preston. English and French parties successful. (Signed)

E. S. HOLDEN.

From a fuller telegraphic report in the *New-York tribune*, it appears that our party reached Caroline Island on April 20, and the French party two days later. The weather was favorable on the day of the eclipse, and all the observations that had been planned were fully carried out. The English observers who accompanied the American party, and to whom all photographic observations were made over, obtained negatives both of the corona and of its spectrum, the latter containing a number of bright lines. They also got a photograph of the reversal of the lines at the beginning and end of totality, and presumably a number of other plates at intermediate stages.

The French observers obtained photographs of the corona and of the whole region of sky near the sun (showing the stars — or at least taken for that purpose, in hopes of thus photographically catching Vulcan). They report dark lines in corona spectrum.

Professor Hastings's observations of the change of length in the 1474 line on the east and west sides of the sun relate to a theory recently proposed by him, that the 'apparent corona,' as it may be called, is mainly a *diffraction* phenomenon, the *real* corona itself being only a very narrow ring around the sun, optically widened out by diffraction (not refraction) at the edge of the moon into the extensive halo actually observed. Professor Hastings arranged an apparatus by which the coronal spectrum on both sides of the sun could be simultaneously observed, and found that at the beginning of the totality the 1474 line was 12′ long on the east side, while it was short and faint on the west. As the eclipse advanced, this inequality disappeared, and at its close was reversed, the change being much greater than could be ascribed simply to the moon's motion. While the observation accords satisfactorily with the new theory, it is, however, doubtful whether it will be regarded as *proving* it, since the effect can also be explained simply as a phenomenon of aerial illumination.

The corona is reported as having been bright, with five well-defined streamers, of length not stated. The chromosphere was unusually quiescent.

Messrs. Brown and Preston were left at Honolulu to make pendulum observations. All the members of the party are reported as in good health. The French party are also expected at San Francisco in a day or two.

— The instructions of the Greely-relief party have been published. They are to endeavor to reach Greely by ship if possible. The Proteus has been chartered for the occasion. If unsuccessful, they are to winter at Lifeboat Cove, Littleton Island; though why they should get on the side farthest from the party to be rescued is not clear. Sledge-journeys will be made, if practicable, after winter sets in; though the time when Smith's Sound may be crossed by sledges to Cape Isabella cannot be early in the season, and may not present itself at all. 'Three hard-ice men' are to be taken from St. Johns, and apparently will be the only members of the party having any knowledge or experience of the arctic regions, the rest being officers and enlisted men of the U. S. army. As the expedition has been contemplated for a year at least, it seems unfortunate that the experience of Lieut. Schwatka could not have been brought to bear on the outfit and plans. The instructions state that Greely's supplies will be exhausted in the coming autumn, which is a surprise to those who were informed by the public prints, at the time his expedition set out, that he was provisioned for three years. It is evident that the question of rescue is even more grave than has been generally understood, especially when the usual impracticability of crossing Lady Franklin Sound on the ice (as established by the Nares expedition) is taken into account. Mr. Beebe will not accompany the relief party. The U. S. S. Yantic will accompany the Proteus as tender.

Messrs. H. G. Dresel and A. A. Ackerman, ensigns, U. S. navy, accompany the Greely relief party to Greenland as naturalists attached to the U. S. S. Yantic. Both of these gentlemen have, during the past eight months, been acting as assistants in the U. S. national museum at Washington, the former in the department of fish, the latter in the department of mineralogy. They are mainly equipped for collecting marine objects, and interesting results in the line of fish and marine invertebrates are expected from them.

— *Nature* states, that at a meeting of the subscribers to the Balfour memorial fund, held at Cambridge on the 26th inst., it was stated that £8,309 had been promised, all except £100 of which had been paid. Of this, £8,078 had been invested, yielding an annual income of £284 10*s.*, which it was hoped further subscriptions would raise to £300. Among the regulations agreed to were the following: the income of the fund shall be applied, (1) to endow a studentship, the holder of which shall devote himself

to original research in biology, especially animal morphology; (2) to further, by occasional grants of money, original research in the same subject. The student shall not necessarily be a member of the university, and, during his tenure of the studentship, shall devote himself to original biological inquiry, and shall not systematically follow any business or profession, or engage in any educational or other work, which, in the opinion of those charged with the administration of the fund, would interfere with his original inquiries. The place and nature of the studies of the student shall be subject to the approval of the managers, provided that the student shall be bound to pursue his studies within the university during at least three terms during his tenure of the studentship, unless the managers shall, with the approval of the board, dispense with this requirement for special reasons. The managers shall take such steps as they may think necessary to satisfy themselves as to the diligence and progress of the student, and may require from him any reports or other information on the subject of his studies which they may think desirable. The studentship shall be tenable for three years; but it may be continued over a second term of three years (but no longer) to the same person, if the managers and board decide that it would be clearly in the interests of biological research. The balance of the income of the fund, after providing for the studentship and for any necessary expenses connected with the election, shall be devoted to the furtherance of original research in biology, especially animal morphology. Grants may be made for this purpose either to the holder of the Balfour studentship or to any other person engaged in research.

— From a circular issued to the members of the American committee of the Balfour memorial fund, we learn that the subscriptions received by the treasurer up to June 11 amounted to $634.95. The expenses incurred were $31.05, leaving a balance of $603.90, which has been forwarded to the general treasurer of the fund in England.

— During the winter of 1883–84, series of lessons will be delivered before the Teachers' school of science in the Lowell free courses. Teachers will please note the fact, that these lessons are chiefly upon one subject, chemistry, and that the first course of five, by Mr. Norton, is preparatory for the other two courses. First course: Elements of chemistry, by Lewis M. Norton of the Massachusetts institute of technology; First principles of chemistry; The chemistry of the air; The chemistry of the water; The chemistry of combustion; The chemistry of the metallic elements. This course will be illustrated by the simplest apparatus which can be used for such purposes. Second course: Practical examination, with simple apparatus, of the physics and chemistry of vegetable physiology, by Professor George L. Goodale of Harvard university; Vegetable assimilation; The mode in which plants prepare food for themselves and for animals; The kinds of food stored in vegetable organs; Illustrations of the starches, sugars, oils, and albuminoidal matters; How food is used by plants and animals in the formation of new parts; Mechanics of growth; How food is used in work of all kinds by different organisms; Adaptation of organisms to extremes of heat and light, chiefly with respect to geographical distribution. The teachers in the audience will be supplied with simple apparatus; and this course and Mr. Crosby's will be made experimental and thoroughly practical so far as this is possible. The series will be concluded by five lessons on chemical principles illustrated by common minerals, by W. O. Crosby of the Massachusetts institute of technology, which cannot at present be more fully described.

— The new Fish-commission steamer Albatross has recently arrived at the Brooklyn (N.Y.) navy-yard from her first extended cruise, which covered the region from Cape Hatteras to Newport (R.I.). The main object of this cruise was to thoroughly test the various appliances of research before starting upon the regular campaign, which will begin about July 1. A considerable amount of stormy weather was encountered; but in the worst of it the new ship behaved splendidly, the greatest roll recorded having been only about 29 degrees. Numerous dredgings and soundings were made down to a depth of 1,168 fathoms, and a large amount of valuable zoölogical material was obtained. Experiments were also made with the powerful electric lamps for lighting up the sea. Considering the inexperienced crew, and the newness of all the appliances, this first trip has been entirely satisfactory. At Brooklyn the Albatross will receive a new coat of paint, after which she will repair to Washington to fit up for the summer work.

— The summer investigating party of the U. S. fish-commission, with the commissioner, Professor Baird, will leave for the Wood's Holl (Mass.) station about July 1, for a stay of three months or longer. The party will consist of the same members as during the past two years, Professor Verrill, of Yale college, being in immediate charge of the zoölogical work. The new steamer Albatross will make her trips from the same place, and the Fish Hawk will engage in dredging and trawling in the neighboring regions. Arrangements are now nearly completed for starting work upon the new wharf in the big harbor, and upon the laboratory and dormitory buildings, which are to occupy sites at the inner end of the wharf. These structures will all be in readiness for the season of 1884.

— The new Parkes museum of hygiene was opened in London, May 26. The Duke of Albany delivered the opening address. Among the speakers were Sir Charles Dilke, Professor Tyndall, and the Archbishop of York.

PUBLISHER'S DEPARTMENT.

CHEAP FOOD FOR THE MILLION.

BY CHARLES S. BRAY, M.D.

[*From "The Century Magazine" for July.*]

I. INIQUITOUS ADULTERATION.

"THERE has been so much adulteration of food," said a New-York divine recently, "that it is an *amazement to me that there is a healthy man in America*. The great want of to-day is practical religion, — a religion that will correctly label goods, that will prevent a man telling you a watch was made in Geneva when it was made in Massachusetts, that will keep the ground glass and the sand out of the sugar, that will go into the grocery and pull out the plug of ale-adulterated sirup, that will dump in the ash-barrel the cassia-buds that are sold for cinnamon, that will sift out the Prussian-blue from the tea-leaves, that will keep out of flour the plaster of Paris and soapstone, that will separate the one quart of Ridgewood water from the one honest drop of cow's milk, that will throw out the live animalculae from the sugar. Heaven knows what they put in the spices, in the butter, or the drugs; but chemical analysis and the microscope have made wonderful discoveries."

"The Youth's Companion," in a recent article on the adulteration of food, says, —

> "A system of inspection is necessary to protect the public from the adulteration of food which is so common in this country, especially in the poorer quarters of our large cities, where the prices are low and the purchasers not fastidious. . . . Large quantities of unwholesome meat are sold to the poor, such as poultry which has been thrown out of the better class of markets, 'bob' veal, the meat of calves killed too soon after birth, and beef that comes from animals that have been unhealthy before slaughtering. . . . The health of a community can be seriously injured by the tricks of dishonest tradesmen, and people should be careful in buying food that is offered at unusually low prices."

These strictures may, perhaps, strike the average reader as foreshadowing a crusade against the compounders and venders of adulterated food; but this is not our prime object. The combined power of the pulpit and press is almost incalculable, and the batteries of the latter are being levelled against this "common enemy" along the whole line. That men, induced by the hope of gain, should adulterate the staples of life, and thus add crime, and, as often follows, murder, to their account on the "Great Ledger" of eternity, seems almost impossible of conception; and yet it is only too true. This criminal practice is as old as the hills; and its recent condemnation by the clergy and press is only another exemplification of the value of free speech and a free press, — two inestimable boons to Americans.

II. SPOILED FOOD.

It is a fact, lamentable enough in itself, that food has a natural tendency to decay, which men have heretofore unsuccessfully attempted to check. Especially is this true of animal food and its after-products, such as butter, cream, milk, cheese, lard, etc. The problem of pure, fresh, healthful, cheap food, in all climates and seasons, is a field broad enough to command the attention of all philanthropists. To the rich man all things seem possible; but to the laboring classes this problem of fresh and cheap food is, and ever has been, a veritable Gordian knot.

The laboring man looks forward to Sunday for a day of rest and a good dinner. The steak, oysters, chop, chicken, and such delicacies are procured on Saturday, and kept over for this sabbath meal. It goes without saying, that a lack of ice, a warm room, a muggy day, a poorly ventilated cellar, and a myriad of such every-day causes and circumstances, conspire to spoil these viands. Even slightly salted, they lose their fresh flavor; smoked, they are even less desirable; immersed in pickle, or corned, they become impregnated with the deadly saltpetre; placed in a refrigerator, they are practically frozen.

"All such food is injurious to health," says a learned Cincinnati judge; yet, left alone to the influences of climate, weather, and natural surroundings, they speedily spoil. What, then, shall rich or poor do to insure the coveted luxury of fresh, healthful food?

The problem has been a knotty one since the advent of man upon this terrestrial planet. The criminal cupidity of many dealers, on the one hand, and the hosts of natural causes of decay, and man's inability to find a reliable, safe, and cheap food-preservative, on the other, are obstacles which have always heretofore confounded the world.

III. FOOD-PRESERVATION.

One of the largest elements of risk in general farming and in dealing in food-products is the loss on perishable goods, both from decay and deterioration, as well as from the frequent necessity of forcing such goods upon an overstocked market at ruinously low prices. The world has long needed some substance, at once harmless and efficient, to maintain in their production that freshness and sweetness in provisions so essential to remunerative returns. Salted meats are distasteful to many, and repugnant and unhealthful to all, where a regular diet of such material is maintained. Once salted, a piece of beef is immediately lowered in value. Millions of dollars' worth of poultry, lamb, veal, and mutton are annually lost to the world through the lack of practical means of preservation. Milk and cream cannot be kept longer than a day or two, and tons of butter every year become rancid and are sold for grease. The want of a thing always directs scientific inquiry and inventive genius toward its discovery. It has been known for many months past, in commercial and scientific circles, that this important discovery had been made in a food-preservative by Prof. R. F. Humiston of Boston. A series of experiments was conducted to prove beyond a doubt the success of his invention, which resulted most satisfactorily to a number of leading capitalists and scientific men, who determined to bring it before the public in a large commercial way.

Professor Humiston must hereafter go down to posterity as an inventor or discoverer as great as Franklin, Morse, Fulton, or Sir Humphry Davy, and for the sufficient reason that he has, after long and patient years of study and research, with thousands of experiments, discovered and perfected a combination of antiseptics, harmless in their nature, which is a *perfect* substitute for ice, salt, sugar, smoke, heat, alcohol, sulphur, — all the agents, indeed, hitherto employed by man in attempting to save food. By the use of this preservative — which has been happily named "Rex Magnus" (for it is indeed the "great king" of preservatives) — all organic matter can be preserved from decay without the use of any of the agents above enumerated.

The process is cheap, simple, and perfect; and the results are certain, regardless of seasons or climates.

IV. THE NEW PROCESS.

In brief, the new process is based upon truly scientific principles, perfectly adapted to the preservation of a great variety of animal and vegetable products. The basis is a tasteless, innocuous white powder, which is dissolved in water, forming a solution in which the beef, or turkey, or mutton is immersed and treated, or which may be injected into the carotid artery of large animals as soon as the blood ceases flowing. By this simple and inexpensive process, the article thus treated may be hung up in ordinary temperature, remaining sweet and wholesome for an indefinite term. Upon the closest scrutiny and the most practical and exhaustive experiments, certain well-known business gentlemen of Boston and vicinity have associated themselves into a corporation, under the name of The Humiston Food-Preserving Company, choosing Mr. J. Willard Rice of Boston, of the well-known paper firm of Rice, Kendall, & Co., as their president, and Dr. R. C. Flower, secretary and treasurer. This company has established a large manufactory at Salem, Mass., with a daily capacity of five tons of Rex Magnus, and their headquarters at 72 Kilby Street, Mason Building, Boston, where may be seen and examined a most interesting exhibit of fish, fowl, game, beef, mutton, and like perishable articles of food, treated with Rex Magnus, and exposed to the atmosphere of a business office, and to the rays of the sun.

The public will naturally wish to know the means or the action by which this Humiston food-preservative performs its important work. In fact, the question is already asked, "Why is it that this preserves, perfectly sweet and pure, for an indefinite period, meats, fruits, vegetables, milk, butter, etc.?"

It is the office of Rex Magnus to oppose and prevent putrefaction by the utter destruction, or holding at bay, of those parasites that prey upon organic matter. Meats, poultry,

game, cream, milk, or oysters, preserved by this method may be carried across the continent, or shipped to Europe, retaining their freshness and purity without the use of ice or any refrigerating appliance, or they may be kept at home for days and weeks, even in the hottest weather, improving in taste, besides saving much expense in the cost of ice, and time and trouble in going to market. There is ample testimony that these are stubborn facts. It is infallible in its power to preserve, of great strength, and concentrated in form, tasteless and unobjectionable to the palate, harmless in its effect upon the human system, and, finally, capable of almost universal and simple application to such food-substances as are subject to speedy decay. The food treated with Rex Magnus carries no unusual or unnatural taste. Its use is so simple that a child may direct the operation of preserving food. The article to be preserved may be wrapped in cloths wet in the solution, and occasionally redampened, or it may be plunged into a tub or jar full of the solution, and allowed to remain for several hours. The powder may be worked into butter at the time of making, or the balls of butter may be placed in vessels filled with the solution, and allowed to remain for weeks and months. Dairymen have preserved butter with all the freshness and aroma of the June product for six months, and Professor Humiston has preserved eggs entirely fresh and sweet for fourteen months at a time.

V. THOROUGHLY INDORSED.

It has been subjected to the most severe and thorough tests, both by scientific, medical, and business men. Professor Samuel W. Johnson of Yale College, after testing it to his entire satisfaction, made a report, in which he says,—

"My tests of thirty-five days, in daily mean temperature of 70°, on meats, etc., bought in open market, have certainly been severe; and I am satisfied that the different brands of Rex Magnus, The Humiston Food-Preservative, with which I have experimented, *have accomplished all claimed for them.* So far as I have yet learned, *they are the only preparations that are effective and at the same time practicable* for domestic use. At the banquet on 'treated' meats at the New-Haven House, *I could not distinguish between those which had been sixteen days in my laboratory and those newly taken from the refrigerator of the hotel.* The oysters were perfectly palatable, and fresh to my taste, and better, as it happened, than those served at the same time, which were recently taken from the shell. The roast beef, steak, chicken, turkey, and quail *were all as good as I have ever eaten.* I should anticipate *no ill results* from its use, and consider it *no more harmful than common salt.*"

Rex Magnus is a valuable discovery, a boon to agriculturists, a legitimate business enterprise. It is not to be classed for a moment with the numerous humbugs of the past, —ozone, and a host of such, the impossible projects of scheming men or the visionary dreams of laboratory scientists. Professor Humiston has devoted many years to studying to assist the millions to get cheap food, and, as the great aid to this end, made intense application and active research in the matter of antiseptics alone. He perfected his process, he proved his theories, he demonstrated the feasibility of his methods, he enlisted his co-operators, he secured the necessary capital, the company was organized, who bought extensive works, and they commenced on a commercial basis before they took measures to inform the pubic of this wonderful preservative.

VI. A BUSINESS BASIS.

This company is not seeking capital of the public: they simply propose to manufacture this preservative on a large scale, to offer it for sale eventually in every grocery and provision store in the land in large or small packages. All classes now have an opportunity of purchasing the preservative in small and inexpensive packages, and of testing, each for himself, its value in his own home and business. There is no opportunity or design for any misrepresentation or serious disappointment in a fair, open transaction like this. There are no territorial rights or patent licenses for sale, but every one may have equal and ample chance to use Rex Magnus. The company offer, however, to supply any one—in case his grocer, druggist, or general storekeeper hasn't it on hand—with any brand of Rex Magnus which he may desire, upon receipt of the price. They will prepay postage charges on *sample* packages, which cost but fifty cents per pound for meats, milk, and sea-food, while cream and other special brands cost one dollar per pound.

VII. PREVIOUS FAILURES.

The wretched failures by which the public has heretofore been deceived have pretended to preserve all kinds of food with the same compound,—an idea which is preposterous on the face of it. Meat is different in character and substance from sea-food, and this from milk, cream, and butter, these from eggs, and eggs from vegetable juices or fluid extracts. Professor Humiston has treated the subject in a scientific way. Having thoroughly inves-

tigated the question of antiseptics, he found the properties and chemical analyses of the different kinds of food, and then, after thousands of experiments, having fully learned what antiseptics and what proportions were best adapted for each, he compounded his preparations intelligently, each to the purpose for which it is especially designed. Herein lies his success, and it is herein that all others have failed.

VIII. HIGH TESTIMONY.

The famous Miss Juliet Corson, in a recent article in "Harper's Bazar," on "Diet for Invalids," and treating especially of game and poultry, says, —

"While the general rule holds good, that fresh food is the most wholesome, and that actual decay in animal flesh used for food is apt to produce symptoms of irritant poisoning, game is often eaten in an advanced stage of decomposition without any perceptible injury to the epicure. Microscopic examination of meat which has been exposed to a medium summer temperature from 85° to 90° Fahrenheit, for three or four days, proves the development, at that stage, of a minute organism, termed by physiologists the death vibrio. This parasite seems to be present in other meats than pork, and, like trichinæ, is not destroyed by the process of salting and smoking meat, or of curing it in brine. There is no reason to suppose that the flesh of game is exempt from the presence of this natural product of decomposition. When meats containing it are imperfectly cooked, their consumption produces gastric disturbance, sometimes fatal in its result. As game is generally broiled or roasted, the action of intense heat may destroy the septic influence of the organism.

. . . .

"I have considered this rather unpleasant subject at length with the hope that when game is ordered for an invalid the caterer may be induced to supply it as fresh as possible. As a rule, the flesh of game is less dense and tough than that of domestic animals, so that there is not the same reason for keeping it, in order to let it become tender by the first action of decomposition. Game is also more digestible than butcher's meat, and for that reason may be eaten fresher. Its comparative freedom from fat makes it relatively more nutritious, while its intense flavor is tempting to the appetite. As the taste of the flesh and blood of game is nearly identical, the latter is generally carefully preserved in cooking."

It is in such cases as referred to by Miss Corson that Rex Magnus plays a most important part. It is of the utmost moment that the food of invalids, as well as of people in good health, should be tempting in quality and appearance, appetizing in flavor, and tender and easy of mastication; but at the same time, and above all, it must be perfectly sweet and fresh. Special care must also be taken that the living creature from which it is derived was in a perfect state of health, as otherwise germs of disease may be taken into the weak and enfeebled system, which perhaps would have no detrimental effect upon a state of health. Rex Magnus will, as we have already shown, enable invalids and others to keep meats, wild game, and other like delicacies, in a condition perfectly sweet and fresh for any reasonable time: sweet-breads have been kept four months, and cream nearly as long, and both sweet, and known as difficult to keep. Game can be treated with it when first killed, and then shipped to market; or, by taking care to purchase only that which is sound and good, it can be treated at home, and then kept until wanted, improving in quality, and growing more tender, digestible, and wholesome. It goes farther, and is of even greater value to the million as a preventive of disease and an aid to health. It not only arrests and prevents decay, and thereby obviates the danger of eating partially decomposed food, but it counteracts and destroys any hidden germs of disease, and renders all articles treated by it wholesome and harmless. In this respect it is a great boon to mankind.

Professor Humiston is a little over fifty years of age, is a native of that grand old town, Great Barrington, Mass. He received his M.A. at the Western Reserve College. He has the honor of being a Fellow of the Chemical Society of London, and also of the Geological Society, being elected after unusually severe examinations. President Huxley, of the latter society, said that "no American should boast of an election without a hard struggle." In evidence of this prejudice toward Americans, the fact that Professor Humiston was given two hundred and fifty questions — five times the usual number — may be cited. He is now superintendent of the company's works, which will insure the most careful product for this "mighty king" of food-preservatives. This company is meeting with great success, and deservedly.

SCIENCE appears every Friday. Volumes begin in July and January. To insure publication in current week, all [illegible] must reach Cambridge on Monday. Terms, $5.00 a year in United States and Canada; $6.00 a year in [illegible] countries. Single copies, 15 cents. Advertising rates sent on request. Address all correspondence [illegible] contents of paper to "EDITOR OF SCIENCE, Cambridge, Mass.;" and all business correspondence to MOSES KING, Publisher, Cambridge, Mass.

Contents of this Number.

FRIDAY, JUNE 29, 1883.

THE IMPORT DUTY ON SCIENTIFIC JOURNALS.

THE failure of Congress last session to put books and periodicals on the free list was, whatever some of our literary friends may think, a serious disappointment to many scientific workers. As to the general free-trade question, or the impolicy of imposing a tax on mental culture, we have nothing to say here; and, indeed, nothing that scientific men could say would at present have any practical effect against the influence which the publishers, with their capital and organization, exert whenever they think their interests threatened. We believe, however, that something might be done by a combined effort of American scientific men to get the duty removed from certain specified foreign journals, which no publisher in the United States would ever dream of reprinting, and which in no way compete with any American publication. To take a few examples: the *Quarterly journal of mathematics*, the *Repertorium der physik*, the *Comptes rendus*, and *Pflüger's Archiv für die gesammte physiologie* could never conceivably be reprinted in this country except at a loss. On each number of these journals, as it arrives by mail, the subscriber is nevertheless forced to pay duty before it is delivered to him, and is frequently put also to the additional annoyance of having to go in person to the post-office or customs-house. These vexatious duties protect no American interest. What they do protect, if any thing, is the European investigator from equal competition on the part of American workers, to whom the gaining of a knowledge of what is taking place in other countries in the various branches of science is made as costly as possible.

It is useless to answer that all incorporated educational institutions get their periodicals duty free. Many of the most active workers have no college library within reach; still fewer colleges can afford to subscribe to more than a very limited number of scientific journals; and all busy teachers and investigators know that it is essential to have at least the chief publications in their own special line of work always at hand for immediate consultation, or for perusal in a chance half-hour's leisure, without the necessity of a pilgrimage to a library for the purpose. Happily, the day is rapidly going by when all expected from a college professor was, that he should be pretty well 'up' in a tolerably modern text-book, and be able to hear recitations from it. To maintain a worthy position among his fellows, and do his duty by his students, a professor nowadays must know something of all the recent work of importance in his own line of study; not necessarily know the details in each minute subdivision of it, but at least have skimmed over the recent publications, so as to be able to tell an inquiring student where the latest papers are to be found, and give him some hint as to the comparative value of the investigations of different workers. To do this properly, a professor must have the readiest access to the current literature of his own department. This 'readiest access' implies that he must receive personally all the more important journals at the earliest possible date.

We venture to suggest to the American association for the advancement of science, that it appoint at its next meeting a committee to draw up a definite list of foreign technical journals of mathematics, physics, chemistry, mineralogy, geology, geography, botany, zoölogy, physiology, and ethnology, such as do not compete with any enterprise of any publishing firm in the United states; and then urge upon Congress the passage of a special act, putting these journals on the free list. In England, France, and Germany, there are always to be found members willing to bring before the legislature the legitimate claims of science. We cannot doubt, that, if a suitable bill were drawn up by official representatives of science in the United States, some member of Congress could be found to introduce and support it. If judiciously framed, so as to touch no publisher's pocket, and vigorously

supported by the influence of the scientific men of the country, such a bill could, we feel certain, be passed through Congress, liberating us from this tax, which falls heavier on men the poorer they are and the more faithfully they try to do their duty.

Some of our most esteemed literary idols have lately astonished us by signing a statement which seems to imply, that, in their opinion, American literature needs coddling to keep it alive. They must decide in their own line of work. We are certainly not less proud of, or less desirous to cherish, American science than they are American letters, and, we are bold enough to think, with at least as much reason. We are sure that we give expression to the conviction of all American scientific men when we say that we believe in no isolated American science. The accurate study of nature is the common duty of all civilized peoples: what each does helps all the rest.

In this connection, we are rejoiced to find that most American artists have taken a position in regard to art agreeing with ours in regard to science. The attitude lately taken by certain prominent authors is but one sign, among several, of a certain tendency in Literature to fall from its former lofty ideals; and, losing the characteristics of a profession, to become simply a trade, followed for the sole sake of the money to be made at it. If this does happen, then Art and Science will have to take the place once held by Letters, and strive to keep alive the belief that there are more worthy aims in life than getting the largest possible number of dollars for one's work, whatever it be. We do not, however, now ask our literary friends to expose themselves to a promiscuous, and, as they appear to think, debasing competition: we only ask to be allowed, duty free, a limited number of purely technical journals; and we shall still read with delight the *Autocrat* and the *Professor*, although sorely pained that our own familiar friend, in whom we trusted, has done what lay in his power to make it difficult for us to learn our anatomy.

THE MICROSCOPIC EVIDENCE OF A LOST CONTINENT.

MUCH interest has been attached to St. Paul's rocks, situated in the mid-Atlantic nearly under the equator; since they were stated by Darwin [1] to be unlike any rock he had ever met, and that they were not volcanic. Darwin's words have caused these rocks to be looked upon as forming a portion of the lost Atlantis; those holding that view overlooking the fact that Darwin simply meant that they were not rocks of volcanic origin such as those he had any acquaintance with. That they were not eruptive or volcanic of earlier date than the other islands in the Atlantic, he was not in a position to assert, and evidently did not intend to do so. Being of different material from the other Atlantic islands, they might even be of comparatively modern origin, and still not show especial traces of their eruptive character. Situated as these islands are, no relation of the rocks of which they are composed to the adjacent rocks can be ascertained: hence the only resort is to study the structure and composition of the rock-mass itself, and to ascertain what evidence it may afford.

When these rocks were examined *in situ* by the members of the Challenger expedition, they were thought by Mr. Buchanan to be referable to the serpentine group, but by Prof. Wyville Thomson to have been formed by the 'ejecta of sea-fowl.' [2]

In this state of affairs, the material collected was wisely placed by Mr. John Murray, who had charge of the Challenger material, in the hands of a competent lithologist, Rev. A. Renard, S.J., curator of the royal museum of natural history at Brussels.

When studied microscopically these rocks were found to be composed of olivine, enstatite, actinolite, chromite, or picotite, and a pyroxene mineral. When M. Renard first examined these rocks, he thought that he discovered in them certain structures which he regarded as fluidal.[3] He therefore held that these rocks were of eruptive origin; but in some publications recently issued he has modified his views, and is inclined to regard the structures seen as schistose and not fluidal.[4]

M. Renard then endeavors to show that these may be metamorphic sedimentary rocks

[1] Volcanic islands, 1851, pp. 31–33, 125.
[2] Voyage of the Challenger, ii. 100–106.
[3] Neues Jahrb. min., 1879, 389–394.
[4] Description lithologique des récifs de St. Paul (Ann. soc. belge micr., 1882, 53 pp.); Report on the petrology of the rocks of St. Paul (Scient. results voyage Challenger, 1873–76, Narrative, 1882, ii. app. B, 29 pp., 1 plate).

and therefore, according to him, true schists; hence he would argue they are the remains of an extensive land area — an Atlantis — of which, owing to denudation, only these few remains are left. His arguments are based on the apparent microscopic schistose structure of the St. Paul's rock, and on the fact that certain olivine rocks have been found associated with crystalline schists.

In examining the first evidence, the writer may state, that he has in his possession two specimens of these rocks, sent him by Mr. John Murray; and therefore the evidence that their sections afford will be given. The sections of one — the least altered — are composed of olivine, enstatite, diallage, picotite or chromite, magnetite, pyrite, actinolite, and serpentine.

While M. Renard remarks that all the minerals have their principal axis parallel with the supposed schistose or fluidal structure, they are found by me to stand in every direction regarding that structure, — even at right angles to one another. Indeed, no structure has been seen by me that I can regard as truly schistose or fluidal.

A structure does exist somewhat resembling a schistose one, which appears to be the result of secondary alteration of the rock-mass. M. Renard states that the rock is fresh and unaltered in certain of the specimens, and one of mine answers to his description of his supposed unaltered rock. He further states, that the structure of this rock is peculiar, and unlike that of other olivine rocks. My sections lead me to a somewhat different conclusion. In them, portions were found that I regard as the original, unaltered rock. These showed the same structure and characters that other unaltered olivine rocks show, and do not appear to be of any abnormal type.

The main portion of the rock which M. Renard regarded as groundmass, and held to be unchanged, is, in my opinion, greatly altered, and contains only remnants of the original minerals of the rock. He regards this groundmass as composed entirely of olivine grains, but of this I have grave doubts. The microscopic characters of this groundmass do not appear to me to be those of ordinary olivine, but rather those of minerals of secondary origin. That this groundmass is of secondary origin, for the most part, is shown by its occurrence along the fissures in the unaltered olivine; by its relations to the minerals that it surrounds, — which relations are the same as those existing between the original minerals and their alteration products in other rocks; and by the so-called schistose structure. I do not design to call in question the work of M. Renard, who is a thoroughly competent observer, and whose sections have not been seen, but rather to show that the characters in my sections do not, in my judgment, bear out the conclusion derived by him from his. Questions of this kind are largely dependent upon the methods of work and the kind of study to which the observer has devoted himself. M. Renard has given much time to the study of crystalline schists and the older eruptive rocks; while the present writer has, for a number of years, devoted much of his time to the study of unaltered rocks, and to the tracing of their various types through to the extreme phases of alteration, studying both modern and ancient forms, with especial reference to their origin and development. It is therefore natural that we should both look at the St. Paul's rocks from a somewhat different stand-point.

But to continue. It is contrary to the laws of physics and chemistry, that a mineral in the process of alteration should produce itself again. Alteration is rather a passage from an unstable to a more stable compound in the conditions to which the rock is then exposed: hence the resulting mineral in this case must belong either to another variety of olivine, or to a distinct mineral species. This would hold good if more than one mineral should be formed.

The actinolite, picotite or chromite, magnetite, pyrite, and serpentine, are regarded by me as secondary products in this case, and not original minerals.

In the places showing the unaltered condition of the rock, the granular structure is the same as that believed to be due to crystallization from an igneous magma, and not owing to detrital action.

The specimens sent me show that they are surface and weathered specimens, to which cause is probably due much of the difficulty met in their study. It is to be hoped, that, should St. Paul rocks be visited again, great pains will be taken to procure specimens as far in the solid rock as possible.

Microscopically, then, the writer holds that these rocks afford evidence in their structure and composition favoring the view that they are eruptive, while in his sections he can find nothing supporting the theory of M. Renard.

It now remains to look at the question of the association of olivine rocks with schists as proving that they are both of a common origin.

This line of argument the writer had occa-

sion to meet in reference to rocks of a different composition a few years ago.[1] M. Renard's line of argument would prove that a dike in conglomerate had the same origin as the conglomerate itself, — would prove, that, when sandstones and lava-flows are interbedded, both have a common origin. In any volcanic district we have mingled in inextricable confusion lava-flows, ashes, scoriae, dikes, and sedimentary rocks: are these all of common origin because they are associated? Is a lava-flow, buried by the seashore sands, of like origin with the sand? In our older rocks we have dikes cutting in every direction: are they the same as the rocks they cut?

The only proof regarding the origin of associated rocks is the relation that they bear to one another: the mere fact of association in itself is no proof.

In another respect M. Renard's argument is faulty, inasmuch as it assumes that all crystalline schists are of sedimentary origin. Eruptive are, as a rule, more subject to alteration than sedimentary rocks; therefore, in proportion to their abundance, they are more commonly found as metamorphic rocks than the others. One of the common metamorphosed characters of eruptive rocks is a schistose structure, and the mere fact that a rock shows such a structure affords no proof of its origin. The writer has seen a well-marked schist cutting in a dike directly across the stratification of a conglomerate, — it was, of course, a metamorphosed basic, eruptive rock, — and he has seen numerous other examples of a similar character.

The best evidence regarding the origin of the olivine rocks is in behalf of their eruptive characters, as M. Renard points out: on the other side, positive evidence seems to be wanting, it being rather a matter of personal opinion than facts. In such cases as those examined by Professor Bonney, and the one studied by the present writer on Lake Superior, the facts and evidence in behalf of their eruptive origin are clear and explicit. So far, then, as the mineralogical constitution of the St. Paul's rocks go, it points rather towards an eruptive than a sedimentary origin for them.

Indeed, did it not, it is difficult to see how any denudation could take place so far down in the sea, as is here required, when, as M. Renard admits, there is no evidence that any sinking has occurred.[2]

The writer would therefore hold that the St. Paul's rocks offer no evidence in favor of their being the remains of a lost Atlantis; but rather that they are of eruptive origin, like the other Atlantic islands, although probably of earlier date than the prevailing rocks upon the latter.

M. E. WADSWORTH.

[1] Proc. Bost. soc. nat. hist., 1880, xx. 470-479.
[2] See also Prof. A. Geikie, *Nature*, 1882, xxvii. 25, 26.

THE PASCAL HEXAGRAM.

THE Royal academy of Belgium in 1879, and again in 1881, offered its prize for a solution of the following question: "To extend as much as possible the theories of the points and lines of Steiner, Kirkman, Cayley, Salmon, Hesse, Bauer, to the properties which are, for higher plane curves and for surfaces and curves in space, the analogues of the theorems of Pascal and Brianchon (see, for these last, the writings of MM. Cremona, P. Serret, and Folie)." The only contestant for the prize in 1881 was Professor Veronese of the university of Padua, whose work on the subject of the original theorems was already well known. To the paper submitted by him, the Belgian academy, advised by its committee, consisting of MM. Folie, Catalan, and de Tilly, declined to award the prize; and the paper has, in consequence, been published in full in the *Annali di matematica* (xi., Dec., 1882, 143 p.) with the report of M. Folie, and a commentary thereon by Veronese. It is a controversy of unusual liveliness for a mathematical one. Before entering upon its merits, we shall give a summary of the memoir of Professor Veronese.

The extensions of the properties of the Pascal hexagram hitherto proposed have been special, and not general, and hence are incapable of being carried farther. When, for instance, the six perfectly arbitrary points on the conic are replaced by six generatrices of the hyperboloid, three must be taken from one system, and three from the other; and one gets, with this restriction, only a single pair of lines, corresponding to one conjugate pair of the twenty Steiner points. Cremona's extension to a cubic in space, on the other hand, can be obtained by simple projection from the hexagram in a plane conic. To develop these special, uninteresting, easy results would not be, according to Veronese, to answer the proposed question; so, leaving them one side, he proceeds to the application of a different method, — the theory of substitutions. His method is, in brief, to represent the six points on a conic by six values of a parameter, whose permutations give, from any figure whatever which they represent, seven hundred and twenty figures of the same kind, or a divisor of 720. If, for

instance, the parameters are the homogeneous co-ordinates of a point in a five-dimensional flat, one gets, by permuting them, seven hundred and twenty points, which correspond in twelves to the sixty Pascal lines. The analogy is precise; for the two figures have the same algebraic base, namely, the substitutions. In his former paper, Veronese forms, for convenience, out of the six fundamental points, fifteen triangles, and, out of the sixty Pascal lines and Kirkman points, six configurations Π, consisting each of ten Pascal lines and ten Kirkman points, poles and polars with respect to a conic. He finds, that, in a five-fold flat, to the triangles correspond fifteen surfaces of the second order in four dimensions; to the sixty Pascal lines, sixty surfaces of the fourth order in three dimensions; to the twenty Steiner points, twenty surfaces of the sixth order in two dimensions; and, to the six figures Π, six configurations Π, represented in the theory of groups by the six remarkable six-valued functions found by Serret (*Liouville*, 1850). As a sample of the vast multitude of propositions given concerning these figures and spaces, we may take the following: the seven hundred and twenty points obtained by permuting the six co-ordinates form a hundred and twenty cycles of six points on rational curves of the fifth order. They lie in sixes on conics in twenty-four hundred planes, which pass by hundred and twenties through the twenty intersections of the space unity with the faces of the fundamental pyramid. They are in twenty-fours in four hundred and fifty threefold spaces, which go by thirties through the intersections of the space unity with the fifteen threefold faces of the fundamental pyramid; and in hundred and twenties on thirty-six fourfold spaces, which go by sixes through the intersections of the space unity with the six fourfold faces of the fundamental pyramid. Such properties as these are simple and interesting in space of high degrees; but it is well to utilize them also for space of two and three dimensions, which Veronese does by means of his method of projection (*Math. ann.*, xix.). Thus for every complete tetrahedron, pentagon, and hexagon, in space of three dimensions, he gets configurations of points, lines, and curves, like those of the Pascal hexagram, and so for every triangle, quadrilateral, pentagon, and hexagon of the plane; and he remarks that the same method might be applied to configurations determined by any value of n in a space of $n - 1$ or less dimensions. Another geometrical interpretation of the groups of substitutions of six letters is given by six linear complexes of lines in involution two and two (*Klein*, *math. ann.*, ii.). They determine fifteen surfaces of the second order, whose intersections are sixty curves of the fourth order corresponding to the sixty Pascal lines. There is also a theorem analogous to the Pascal theorem for a rational quartic in fourfold space.

M. Folie, in his report on this paper, complains that the contestant has refused to understand the question in the plain sense in which it was proposed; that he should have started out from the propositions which in M. Folie's book, 'Sur les fondements d'une géométrie supérieure Cartésienne,' are said to be analogous to the Pascal properties, namely, that in a plane cubic curve opposite sides of two quadrilaterals cut in a line, and that in a cubic surface opposite faces of two tetrahedrons cut in four lines in a plane; that, after having extended the question as far as possible in this direction, it was open to him to take another point of view, and even that which he has taken, though that is perhaps least of all susceptible of generalization. This work, he says, is remarkable and highly original, and would have deserved the prize had it been the aim of the academy simply to call forth a work of that description; but its object was to engage young geometers in the way already opened in his own memoirs, and to provoke them to researches which should complete those of the Belgian school of geometers, according to the expression of M. Chasles. This the author has not done: the question, hence, remains unattacked, and will continue to be retained upon the programme of the academy. Veronese, in reply, very pertinently inquires why it was not equally incumbent upon the contestant to follow in the way marked out by the Italian and the French schools, by Cremona and by Serret, and maintains that the prize is wrongly withheld on account of his having followed a new and original way instead of that which M. Folie professes to have pointed out to the geometers of the future. He admits that his results are not very susceptible of generalization, for the reason that they are already so extremely general. He complains that M. Folie has given no idea of the contents of his paper, — the usual task of a *rapporteur*, — and that, in each instance in which he refers to it, he fails to understand it. M. Folie says, for example, that Veronese has applied his method to cubics in space because he could, but not to plane curves or surfaces of order higher than the second, because his method was not there applicable; while, in fact, Veronese obtains

his results for curves in space not at all by application of his method, but by simple projection from the Pascal hexagram. M. Folie objects to Veronese's using the term 'involution' instead of 'cyclic homography;' but an examination of the table of contents might have shown him that Veronese devotes a section of his paper to cyclic homographies, and he gives simply a natural extension to the ordinary meaning of the term 'involution.' But, worst of all, M. Folie makes a singular slip in the enunciation of the original question, for there are no points or lines in the figure which are known as the points or lines of either Hesse or Bauer. At the end, Veronese turns the tables upon his opponent, and points out several striking inconsistencies in his memoirs, and several instances of his peculiar 'art of phrasing:' as, "The greater part of these [M. Folie's] theorems had not yet been discovered, in spite of the depth and penetration of geometers;" "To deduce the corollaries from them would be an enterprise which would require, perhaps, years of labor;" "It is a field which I have cleared, and in which those who follow will find an ample harvest of discoveries."

In conclusion, we can but share the regret expressed by the direction of the *Annali*, that academies should so frequently provide unwisely for the advancement of science, either by proposing subjects which are too special, or by compelling authors to follow in their solution a direction determined *a priori*.

CHRISTINE LADD FRANKLIN.

OCCURRENCE OF AMBER NEAR TRENTON, N.J.

AT the April meeting of the Trenton natural history society, the occurrence of amber in the bed of Crosswicks Creek was referred to, and no one of those present reported success in searching for it. The authority for its occurrence rests wholly, I believe, upon the statement in Comstock's Mineralogy (Boston, 1827), that it occurs 'near Trenton, N.J.,' and, again, "that found near Trenton occurs in small grains, and rests on lignite, or carbonated wood, or even penetrates it" (p. 297). I have several times met with small grains or pebbles of the mineral in the bed of Crosswicks Creek, and in 1860 found a mass as large as a pea, which I gave to the late W. S. Vaux, Esq., of Philadelphia. These small grains of amber, found in the bed of the creek, are undoubtedly derived from the beds of clay which are exposed in the bluff forming the southern bank of the creek. Clays of the same character and age (cretaceous) occur nearer Trenton than Crosswicks Creek; and in them, also, occurs much fossil wood. In and on this, grains of amber are not uncommon. They are usually very small, and difficult to detect. The fossil wood in this cretaceous clay is soft and very 'recent' in appearance, and burns with an uncertain, flickering flame. The scanty traces of amber found with this — derived, I suppose, from it — is the fossilized sap of the trees now found in these deposits of clay.

CHARLES C. ABBOTT.

THE TOTAL SOLAR ECLIPSE OF MAY 6.

THE U. S. S. Hartford, which sailed from Callao, Peru, March 22, with the American and English astronomers on board, arrived at Caroline Island April 20, sixteen days before the date of the eclipse. The island is in reality a chain of small islands of coral formation, encircling a lagoon; the length of the enclosure being about seven miles and a half, and the breadth one mile and a half. The land is low, but supports an excellent growth of grass and other vegetation, including a number of cocoanut-trees. There are no permanent inhabitants; but the island is leased by an English firm which deals in guano, cocoanuts, and other products of this and similar Pacific islands. An agent of this firm visits the island occasionally, and superintends the work of those employed. Seven persons were found living on the island for the time being, having been brought there from Tahiti two months before. These were four men, one woman, and two children. There were two large frame houses in excellent condition, besides several smaller houses, which furnished comfortable accommodations for the party, and also for the French astronomers, who arrived two days later in the L'Eclaireur. The latter party was composed of the following scientific men: M. Janssen of Meudon; M. Tacchini of Rome; M. Palisa of Vienna, formerly of Pola; M. Trouvelot of Meudon, formerly of Cambridge, Mass.; and M. Pasteur, photographer, also of Meudon.

The landing of the heavy cases containing the instruments was accomplished with difficulty, as even the small ship's boats could not come within several hundred feet of the shore, which was composed of rough coral rock. The cases were taken from the boats by men standing in about two feet of water, and carried to the shore, thence across several hundred feet of coral rock to the land, and about a quarter of a mile farther to the site selected for the ob-

servations. After the completion of the landing, the men-of-war steamed away to Tahiti, leaving selected members of their companies to assist in the work. The American party was favored with the help of Messrs. Qualtrough, Dixon, Fletcher, and Doyle, officers of the Hartford, and of ten seamen.

The two weeks preceding the eclipse were occupied in mounting the instruments and in other preparations. Pendulum observations during this time were made by Messrs. Preston and Brown, under instructions from the U. S. coast and geodetic survey. The weather was in general pleasant; though there was one severe rain-storm, and nearly every day there were flying clouds with slight showers, as is not unusual in the region of the trade-winds. The wind was usually strong, and blew steadily from a direction varying from north to east, but never south of east, though the island is in the heart of the south-east trade region. Eight inches of rain fell during the seventeen days which the party spent on the island, more than half of this in one storm on May 4.

The weather on the morning of May 6 was cloudy and threatening; but after several showers the sky cleared shortly before the time of first contact, and remained clear the remainder of the day, with rapidly moving clouds. One of these partially concealed the corona for about twenty seconds in the first minute of totality, and the sun was wholly in a cloud soon after the close of totality; but the observations were not interfered with, though there was at all times haze in the atmosphere. Your readers have already been informed of the nature of the observations planned. All these were carried out successfully, with results which will be given in full detail in the official report of the expedition. A summary of these results can, however, be given at the present time. Professor Holden swept for intra-Mercurial planets, but discovered none. Spectroscopic observations were made by Dr. Hastings and Messrs. Rockwell, Brown, and Upton, with interesting results. Dr. Hastings had devised a spectroscope by which the spectra of two opposite sides of the sun were brought into juxtaposition, and could be examined simultaneously. This instrument, which was attached to a $6\frac{1}{4}$-inch equatorial, was used especially to note the changes in the appearance of the 1474 line on the preceding and following limbs of the sun as the eclipse progressed. At the beginning of totality the 1474 line extended to a height of about 12′ on the eastern limb of the sun, while on the western limb it was faint, and not more than 4′ in height. As the eclipse progressed, the lines changed relatively, becoming sensibly equal at mid-eclipse, and the conditions at the close of totality being the reverse of those at the beginning. This change was many times greater than any change due to the moon's motion, and is regarded by Dr. Hastings as conclusive proof that the outer corona is mainly due to diffraction. The dark D lines were seen in the corona, and the bright hydrogen and magnesium lines by several observers. The relative height and brightness of the coronal rings seen in an integrating spectroscope were estimated.

The duration of totality was five minutes twenty-five seconds. The corona was bright, and characterized by five well-defined streamers, a careful sketch of which was made by Dr. Dixon. The azimuths of the shadow-fringes at the beginning and end of totality were obtained, and their distances from each other estimated. The meteorological observations made by Mr. Upton showed a slight but well-defined rise in barometric pressure, a rise in humidity, and a fall in temperature. The temperature reached the values given at night, while the radiation thermometers indicated that the receipt of heat by the earth was almost wholly checked. The direction and velocity of the wind were unchanged during the time of the eclipse.

The photographs obtained by Messrs. Lawrance and Woods, the English members of the party, who were assisted by Mr. Qualtrough of the Hartford, include a series of negatives of the corona to its outer limits, and also of the coronal spectrum. The latter contains a few bright lines, but not as many as were obtained by the same observers in Egypt a year ago. The phenomenon of reversal of the Frauenhofer lines was also successfully photographed.

The French astronomers obtained many photographic negatives of the corona, and of the sky in the vicinity of the sun, to aid in the search for Vulcan. M. Palisa searched for intra-Mercurial planets without success. M. Janssen saw dark lines in the coronal spectrum, and M. Tacchini a faint spectrum resembling that of comets in one of the coronal streamers. M. Trouvelot made a sketch of the corona, and devoted also a portion of the time to the search for intra-Mercurial planets.

The Hartford returned to Caroline Island on the 8th of May, and on the 9th sailed for Honolulu, which was reached on the 30th; a stop of four days having been made at Hilo, Hawaii, to allow a visit to the volcano of

Kilauea. The members of the expedition, except Messrs. Preston and Brown, who remained at the Hawaiian Islands to make pendulum observations, left Honolulu by the steamer Zealandia on the 4th of June, and arrived at San Francisco June 11. W. U.

FIG. 1.

REGISTERING APPARATUS FOR EARTH-CURRENTS.[1]

FOR the purpose of studying the earth-currents on telegraph-lines, the instrument-maker, Wauschaff of Berlin, has made for the earth-current committee of the German electro-technical society a piece of apparatus, shown in the illustration, which, when connected in circuit with a telegraph-line, will show the varying strength of the current in the line, registering the results on a diagram. The earth-currents are generally very weak, and only can be shown by the most delicate galvanometers, so that no registering apparatus requiring a great amount of force could be used. This necessitated the use of photography. That the observations might be independent of the hour of the day, an artificial source of light was used. The most sensitive dry plates were employed, and, to keep out all extraneous light, the

[1] From the April number of *Zeitschrift für instrumentenkunde.*

whole apparatus is covered with a wooden box, removed in the illustration. This cover turns on the hinges at *c*, and, when closed, rests in the grooves *f*. The tubes *r* and *r′* are furnished with two cloth-lined metal collars, which can be pressed up against the box where the tubes pass through it. The outer end of *r* is closed with a plate in which there are three round holes side by side in a horizontal line. Before this plate is the diaphragm *d*, which can be turned on a vertical axis, and through which there is one hole. With this diaphragm the central opening in the end of *r* may be alone left open. In front is placed a kerosene lamp. From the flame of this lamp a fine pencil of rays passes through the hole in *d*, along the tubes *r* and *r′*, and is reflected by a total reflecting-prism, *p*, which throws it on the mirror, *G*, of the galvanometer, which is connected in circuit with the line by the wires *z*. From the mirror *G* the light is reflected back through the lens *l*, which brings the rays to a focus on the photographic plate. This plate is put in a holder, *k*, in the slide *S*, before the beginning of the observation. There are spring clamps on *S*, so that, when the cover is drawn from in front of the plate, the holder will remain in *S*. In order that it may be possible to expose the plate after the box-cover is put down, there is a slit covered with rubber cloth in the box; through which the fingers may reach the top of the plate-holder and pull out the sliding front. The slide *S* travels on guides *F*, and on one side is furnished with two rollers, and on the other with one; so that the movement may be as straight as the guide against which the two rollers press. In the front side of *F* there is a horizontal slit at the height of the focus of the rays. The back side of *S* carries a rack which fits a pinion on the driving-axis of the clock *U*. The downward movement of *S* is therefore regulated by this clock, of which it forms the driving-weight. The downward velocity is about 80 mm. per hour. This is sufficient to allow of changes from minute to minute being easily distinguished. For the purpose of allowing different rates of speed, it is proposed to put another rack on the back of *S*, which, by a sliding motion, may be made to catch on a second pinion of different size. For lesser changes the pendulum may be varied in length.

FIG. 2.

The wires leading to the galvanometer are connected with a commutator. When the needle is in its position of rest, a straight line will be marked on the plate by an upward movement of the slide. From this line the deflections caused when the earth-currents pass are measured. Time-signals may be made by turning back the diaphragm *d*, when marks will be made on each side of the neutral line. From time to time, currents of known strength may be sent through the apparatus, and will produce spots, as *b*.

Fig. 2 shows one of the diagrams obtained. The abscissa line was drawn through the portions *a*, which were marked by the light. The portions *a* are broken, and at these points occur the dots *b*, the result of the known currents. *c*, *c* are the time-signals.

A NEW CONDENSING-HYGROMETER.

EVERY one who has had occasion to use the common form of condensing-hygrometer for the determination of the dew-point of the air, as devised by Regnault, has found great difficulty in obtaining satisfactory results, especially if the air is in rapid motion, and there is a great difference between the dew-point and the air-temperature.

Professor Crova of Montpellier, France, recognizing these defects, has devised a new form of this apparatus which obviates many of the difficulties, and goes far toward making this justly important instrument one of precision.

The principle adopted is that of condensing moisture upon the *inside* of a polished cylinder the outside of which has been cooled. This instrument described in the *Journal de physique*, April, 1883, consists essentially of a brass cylinder, nickel plated, and highly polished on the inside, provided with two fine tubes near its ends. Through one of these, by means of a rubber tube conducted to the exterior air or to any point at which it is desired to obtain the hygrometric state, the air is drawn into the polished cylinder by using an aspirating-bulb attached to the other. At the first extremity is placed a ground-glass plate, which permits light to enter. This light appears as a bright annulus enlarged three times, as viewed by a magnifier at the other end.

The cylinder is supported in a box, through the centre of which it passes horizontally. This box is provided with two openings, as in an ordinary condensing-hygrometer, through which, by aspiration or by blowing, ether contained in the box may be evaporated, thus lowering the temperature, which is indicated by a properly adjusted thermometer.

In observing, air is drawn into the cylinder by an aspirating-bulb, and at the same time the ether is evaporated. The moment dew appears on the inside of the cylinder, which is easily seen, the reading of the thermometer gives the dew-point. This may be readily obtained again and again with an error less than 0.1° C., or 0.18° F.

Some of the advantages claimed, are the possibility of guarding against varying air-currents; the delicacy of adjustment; the ease and accuracy of observation with the magnifier; the easy manipulation of a uniform light, so difficult to obtain in the ordinary form; and the use of the apparatus in the house for determining the dew-point of the outer air.

In regard to the last advantage claimed, it may be said, that if accurate results can thus be obtained when the air-temperature is from — 40° to — 60°, or when there is a difference of forty or more degrees between the air-temperature and the dew-point, the instrument will be of great service; but there should be some means of aspirating the outside air through the ether, and the apparatus should be very carefully isolated by non-conductors of heat, as the heat of the room would make a sufficient cooling impossible under the conditions just named. The possibility of easily securing such isolation without interfering with the working of the apparatus seems the most important advantage to be derived from its use.

H. A. HAZEN.

THE RIGHT WHALE OF THE NORTH ATLANTIC.

THE four plates devoted in Dr. Holder's recent paper on this subject[1] to the external and osteological characters of the right whale of the North Atlantic (Balaena cisarctica Cope = B. biscayensis of European cetologists), and the seventeen pages of text descriptive of the same, form a welcome and valuable contribution to the history of a species possessing peculiar interest. Its habitat being the temperate waters of the North Atlantic, — extending from the coast of Florida and the Bay of Biscay, northward to southern Labrador and Iceland, — it was pursued off the coast of Europe for centuries before the Greenland whale (B. mysticetus), the basis of the great northern whaling industry of modern times, became known to Europeans. It was hunted by the Basques and Norwegians as early as the ninth and tenth centuries, was the basis of the whale-fishery of the fifteenth and sixteenth centuries, and was already approaching extinction in European waters, when the great arctic or Greenland whale first attracted the attention of whalers, early in the seventeenth century. The latter, from its greater size, easier capture, and larger numbers, its greater yield of oil and superior quality of baleen, became at once the chief object of pursuit; and the earlier known species was quickly lost sight of as a commercial animal, except on this side of the Atlantic. Here it was the species chiefly hunted by American whalemen down to about the middle of the last century, when from its rarity its pursuit was gradually abandoned for that of the arctic species. The cisarctic animal was early known to the French as the 'sarde;' to the Norwegians, Dutch, and Germans, as the 'nordkaper;' and to the Icelanders as the 'sletbag.' To Americans it was known under the various names of 'northcaper,' 'Grand Bay whale' (in reference to the Bay or Gulf of St. Lawrence, where it was chiefly hunted), 'seven-foot-bone whale,' and 'black whale.' Under these names it was briefly described by various early non-scientific writers, and, in the works of the early systematists, was very inadequately characterized under various systematic names. It is the Balaena glacialis of Klein (1741) and Bonnaterre (1789), the B. islandica of Brisson (1756), and the B. nordcaper of Lacépède (1804). It was, however, practically unknown to science, till the researches of Eschricht and Reinhardt, published in 1861, led to its rediscovery, having been, until then, generally confounded with the B. mysticetus. During recent years it has several times been taken off the coast of southern Europe and in the Mediterranean. These specimens have formed the basis of important memoirs, and given rise to additional specific names. It is, however, now commonly known in Europe as Balaena biscayensis, the name originating really with Gray, although almost universally ascribed to Eschricht, who merely designated the species by an equivalent vernacular name. It was redescribed by Cope in 1865 as B. cisarctica, from a specimen taken at Philadelphia, the skeleton of which is now in the museum of the Philadelphia academy of natural sciences. Ruling out the name 'islandica' of Brisson, on the ground that it antedates the binomial system, and 'glacialis' of Bonnaterre as untenable from its misleading tenor, we have left, of the earlier names, 'nordcaper' of Lacépède, which is objectionable only from its barbarous character, but no more so than hundreds of other names currently employed in zoölogy, save by a few purists who admit nothing that is unclassical.

Dr. Holder describes and figures, 1°. The external characters of a male specimen taken off the New-Jersey coast in the spring of 1882; 2°. The skeleton of a specimen (sex unknown) stranded some years since on Long Island; 3°. Through notes furnished by Dr. G. E. Manigault, a specimen captured in the harbor of Charleston, S.C., in January, 1880. Professor Cope's specimen, and two of the three here mentioned, are more or less immature. There is, however, the skeleton of a fully adult example, taken at Provincetown in 1865, in the Museum of comparative zoölogy, of which, as yet, no description has been published. The New-Jersey example not having been preserved, there exist at present four skeletons of this species in American museums. Dr. Holder figures the skull of the Charleston, the external characters of the New-Jersey, and the

[1] *Bull. Amer. mus. nat. hist.*, vol. i. no. 4, pp. 99-137, pl. x.-xiii., May 1, 1883.

skeleton of the Long-Island specimens, and gives measurements and details of the external characters and osteology, all of the highest importance; our only regret being that he did not, respecting some points, make fuller use of his opportunities. We wish we could speak with equal satisfaction of the historical portion of his paper, comprising one-half of his text. Besides numerous outrageous typographical errors (a part of which, however, are corrected on an *errata* slip), relating to proper names and titles of works ('Researches' and 'Reserches' for 'Recherches,' 'Seibold' for 'Siebold,' 'Van Benedin' for 'Van Beneden,' both the latter in repeated instances, and various others of like character, are among those still uncorrected), there are errors of statement of so grave a character as to require notice. It would seem, for instance, that only the merest novice in cetology could have been misled into supposing that the quotation given at p. 114, respecting a whale captured far up the St. Lawrence River in August, 1871, and reported as 'Balaena mysticetus,' was any thing but a rorqual or finback whale (in all probability, Balaenoptera musculus), much less into an attempt to explain away the evident discrepancies to make it referable to the North Atlantic right whale; yet we find our author devoting several pages to an attempt at this absurdity. Again: in the strictures passed upon Scoresby (pp. 121, 122), he informs us that "his [Scoresby's] inability to portray the subject pictorially was a misfortune," and that "he furnished to science an incorrect figure, at *second hand*," of the B. mysticetus, and considers it 'deplorable' that "nearly every book published to this day, having an illustration of B. mysticetus, shows a manifest copy of Scoresby's figure." That it was the best figure, if not quite correct in all points, of the species down to 1874, when Scammon's admirable illustration was published, has, I think, hitherto been unquestioned; and if our author has evidence that Scoresby's figure (or rather figures, for he gives two) was not original, its presentation would be undoubtedly a revelation to cetologists. That our critic of Scoresby is none too familiar with Scoresby's cetological writings is evident from his statement, that Godman (p. 129) "gives a lengthy account of the mysticetus, with an amount of anatomical and physiological knowledge of the subject quite unusual;" the fact being, that Godman's account is an unaccredited compilation from Scoresby, whole pages being taken entire, and without change, from Scoresby's work, particularly in his notice of the whale-fishery. Bachstrom's figure, published by Lacépède as representing the nordcaper, and which is accepted by Dr. Holder as such, recent eminent authorities have unreservedly referred to B. mysticetus; yet on its interpretation as a representation of the nordcaper rests much of Dr. Holder's criticism of Scoresby. We are surprised to see no reference to the various recent original memoirs relating to the so-called B. biscayensis, either in the author's formal notice of the 'Right whale of Europe' or in the bibliography of the general subject given at the end of the paper. In 'the list of works referred to' the uncorrected errata are numerous; 'J. C. Gray' (four times repeated), for example, standing for 'J. E. Gray,' 'Col. Hamilton' (also on p. 129) for 'W. Jardine,' etc., while there are also inaccuracies of dates. While, as above said, Dr. Holder gives us valuable information about the external appearance and osteology of the North Atlantic right whale, his historical *résumé* is seriously defective and misleading.

J. A. ALLEN.

FIG-INSECTS.

FEW insects offer more remarkable structural peculiarities, or have more puzzled systematists, than the minute Hymenoptera associated with the caprification of figs. Part I. of the transactions of the London entomological society for 1883 opens with a very interesting illustrated paper by Sir Sidney S. Saunders, descriptive of fig-insects allied to Blastophaga from Calcutta, Australia, and Madagascar, with notes on their parasites and on the affinities of their respective races.

It is chiefly as a contribution to the discussion of the affinities of these insects that Mr. Saunders's paper possesses so great an interest. In the transactions for last year, Westwood, by certain authoritative statements, appeared to settle the place of the fig-insects (at least, for the genus Sycophaga) as among the Chalcididae, and not far from Callimome. He remarks, "The structure of these fig-insects, especially as shown in the females (whose character must be shown as more truly normal than that of the males), recedes so entirely from that of the Cynipidae that we cannot for a moment adopt the suggestion that the fig-insects are Cynipidae. . . . Hence M. Coquerel had no hesitation, in describing the female of one of his fig-insects, to give it the name of Chalcis? explorator; and it is impossible to compare his figure of that insect, or mine of Sycophaga crassipes, with a female Callimome, and not be convinced that the fig species are most closely related to Callimome (many of the species of which are parasitic upon the gall-making Cynipidae). The structure of the antennae (even to the minute articulations following the second joint), the fusion of the three terminal joints of these organs, the structure of the wings and wing-veins, and the long exserted ovipositor, sufficiently prove that these insects must be placed in the great family Chalcididae."

Mr. Saunders differs from Westwood in these conclusions, showing that the place of the whole group must not be considered in so sweeping a manner. He disposes of the relationship of the group to Callimome by the following points: 1. The minute articulations in the antennae of the female Sycophaga do not correspond with any in the same sex of Callimome, nor do they occur in Blastophaga, the antennae of which also differ in other respects from Callimome. 2. The fusion of the three terminal joints, while found in Sycophaga, does not occur with Eupristina nor with Agaon. 3. The wing-veins differ *inter se* among the fig-insects, and Callimome does not coincide with Eupristina in this respect; moreover, the wings are invariably absent in the males of the fig-insects. 4. The ovipositor of fig-insects varies in length, and always maintains an arcuate position. The argument which Westwood brought up in a later paper, of the similarity of the dentate genital claspers of Sycophaga to those of Platymesopus and other Chalcids, Saunders disposes of by saying that this character can have no tribal value, as it is found alike in Sycophaga and several of its parasitic associates; moreover, this character is not present in Callimome.

Mr. Saunders's final conclusion is, that this anomalous group which he calls Sycophagides should be placed under the Cynipidae in the following manner: —

1. *Prionastomata.* — Blastophaga Grav., Agaon Dalm., Sycocrypta Coquerel, Eupristina S. Saund., Pleistodonta S. Saund., Kradibia S. Saund.
2. *Aploastomata.* — Sycophaga Westw., Apocrypta Coq.

C. V. RILEY.

OPTICAL RESEARCHES ON GARNET.

It has been for a long time known that all garnets, as well as some other isometric minerals (boracite, analcite, alum, senarmontite, etc.), do not show the action on polarized light which would be required by substances crystallizing in the isometric system; and to find out the causes of these optical variations, and the laws which govern them, C. Klein has examined (*Jahrb. min.*, 1883, 87) as many as three hundred and sixty different garnet sections, cut parallel to different crystallographic planes, and from various localities. His researches do not indicate that because garnets frequently show these optical variations we should refer them to some system of crystallography other than the isometric; for garnets from the same locality often show a great variation in optical properties, some crystals being isotrope throughout, others in part uniaxial or biaxial. Others, on the other hand, have tried to explain the optical variations by regarding the various isometric forms as made up of numerous prisms, either uniaxial or biaxial, united at the centre, and whose bases make up the external crystal faces. Others regard the garnet substance as triclinic, and the various optical properties as the result of repeated microscopic twinning of the same.

The chemical composition does not influence the optical structure of the crystals, because the same optical phenomena are observed in garnets of different composition; and in garnets of the same composition, but with different form, varying optical structures are observed, even among crystals from the same locality. The form, however, in which the various garnets occur, governs the optical structure. Thus, in the octahedral garnets from Elba, what is called the octahedral structure is noticed. A section from this garnet cut parallel to an octahedral face, examined in parallel polarized light with crossed nicols, shows a triangular centre, which remains dark, and three fields on either side, which are alternately dark and light as the section is turned, being dark when one of the sides of the triangle becomes parallel to the plane of either of the nicols. In convergent polarized light, the centre shows the dark cross of a uniaxial crystal, while from each of the three sides a dark bar runs out into the side-fields at right angles to the edge. This indicates a crystalline structure made up of eight uniaxial prisms united at the centre of the crystal, and whose bases form the eight faces of the octahedron. A section cut near the centre of the crystal shows six of these prisms radiating out, while the upper and lower ones have been, of course, cut away. What is called the dodecahedral structure is observed on pure dodecahedrons. A section cut parallel to a dodecahedral face shows, in convergent polarized light, the appearance of two optic axes whose plane lies parallel to the longer diagonal of the rhomb. The tetragonal-trisoctahedral structure observed on crystals of that form shows, in sections parallel to the trisoctahedron faces in convergent polarized light, the appearance of two optic axes with very slight divergence, indicating a crystalline structure made up of twenty-four nearly uniaxial prisms united at the centre, and whose bases are the faces of the trisoctahedron. The plane of the optic axes is normal to the symmetry diagonal of the trisoctahedron face. In the hexoctahedron structure the sections show a biaxial structure, and the plane of the optic axes is very variable. By making and examining artificial gelatine crystals, the author was able to imitate many of the optical variations; and these seemed to be related to a contraction working along the edges of the crystal, and normal to its faces. The greater the contraction along the edges in relation to that normal to the faces, so much greater will be the double refracting power of the crystal. The cause, then, of the optical variations observed in many garnets seems to be tension, caused by unequal contraction, and this being influenced largely by the external elements (edges) of the crystal gives to each form its peculiar optical structure.

S. L. PENFIELD.

GEOLOGICAL NOMENCLATURE.

THE following resolutions concerning nomenclature, coloring, etc., were voted by the recent international geological congress: —

I. Nomenclature.

The elements of the earth's crust are the *mineral masses* (masses minérales).

The mineral masses, regarded from the point of view of their nature, take the name of *rocks*. Considered from the point of view of their origin or mode of formation, they are to be called *formations*.

a. Stratigraphical divisions.

Regarded from the point of view of their age, mineral masses may be subdivided according to the following rules: —

1. The word *group* (groupe) is applied to the three or four great divisions. Ex.: *Secondary group*.
2. The divisions of the groups are designated by the word *system*. Ex.: *Jurassic system*.
3. The divisions of systems of the first grade are designated by the word *series* (série), or by the terms *section* or *abtheilung*. Ex.: *Lower oolitic section or series*.
4. The divisions of systems of the second grade are designated by the word *étage*, or by the corresponding terms, *piano* (Italian), *viso* (Spanish), *stage* (English), *stufe* (German), etc. Ex.: *Étage bajocien*.
5. The divisions of systems of the third grade are designated by the term *assise*, or by its strict equivalents in the different languages. Ex.: *Assise à A. Humphresianus*.
6. The French expression *couches* (beds) may be employed as synonymous with *assise*.
7. A certain number of assises combined will bear the name of *substage* (sous-étage).
8. The first element of stratified masses is the *strate* or *couche*, *schicht* (German), *stratum* (Latin and English), *strato* (Italian), *retek* (Hungarian).

b. Chronological divisions.

9. The word *era* (ère) is applied to the three or four great divisions of time, corresponding to the groups.
10. The length of time corresponding to a system will be rendered by the word *period* (période).
11. The length of time corresponding to a series (section, série, abtheilung) will be expressed by the word *epoch*.
12. The length of time corresponding to a stage (étage) will be expressed by the word *age*.

II. Colors and signs.

1. Crystalline schists, *rose-carmine* (by preference); *bright rose* for the rocks of pre-Cambrian age; *pale rose* for those of indeterminate age.
2. Primary group. Decision referred to the committee of the map of Europe.

3. Secondary group (mesozoic).
   Triassic system, *violet.*
   Jurassic " *blue* (lias, *dark blue*).
   Cretaceous " *green.*
4. Tertiary group (cenozoic), *yellow*, using lighter shades as the beds become more recent.
5. Quaternary deposits. Decision referred to the committee of the map of Europe.
6. Resolutions of detail relative to shades, reserves, etchings, and letter notations.

III. Rules concerning the nomenclature of species.

1. The nomenclature adopted is that in which each animal and plant is designated by a generic name and a specific name.

2. Each one of these names is composed of a single Latin or Latinized word, written according to the rules of Latin orthography.

3. Each species may present a certain number of modifications, related to each other in time or in space, and designated respectively under the name of *mutations* or of *varieties.* The modifications whose origin is doubtful are simply called *forms.* The modifications will be indicated, when requisite, by a third term, preceded, according to the case, by the words *variety*, *mutation*, or *form*, or the corresponding abbreviations.

4. The specific name should always be precisely designated by the indication of the name of the author who established it. This author's name is to be placed in parentheses when the primitive generic name is not preserved; and in this case it is useful to add the name of the author who changed the generic name. The same disposition is applicable to varieties elevated to the rank of species.

5. The name attributed to each genus and to each species is that under which it has been primarily designated, provided the characters of the genus and the species have been published and clearly defined.

Priority will not be carried beyond Linné's Systema naturae, 12th edition, 1766.

6. In future, for specific names, priority will be irrevocably acquired only when the species shall have been not only described, but figured.

LETTERS TO THE EDITOR.

A powerful direct vision spectroscope.

AT a journal meeting in which Professor Rowland and the students of physics take part, an article came up for discussion which needs correction. In *Comptes rendus*, April 9, 1883, Ch. V. Zenger, in a note entitled '*Spectroscope à vision direct très puissant*,' claims a dispersive power equal to that of thirteen sulphide-of-carbon prisms of 60° angle for a spectroscope composed of a parallelopiped of two prisms, — one of quartz, and the other of a mixture of ethyl cinnamate and benzine, — combined with a third prism of crown glass of angle of refraction 27° 13′. He gives as the angles the three rays make with the perpendicular to the last prism after they have passed through, —

A	−90° 0′
D	−55° 15′
H	+42° 55′

It will be easily seen that *H* should be negative in place of positive; which will make the dispersion between *A* and *H* 47° 5′, in place of 132° 55′ which the writer gives. H. R. GOODNOW.

Johns Hopkins university.

Connecticut minerals.

The towns of Middletown, Portland, Haddam, and Chatham, in this state, have long been famed as a region remarkable for the number of minerals occurring in the veins of coarse granite. Within the last few days two minerals have been discovered in these veins, which, so far as I am aware, have not previously been reported.

Torbernite has been found at Andrus' Quarry, near the boundary between Portland and Glastenbury, associated with autunite, the occurrence of which has been previously reported.

Rhodonite has been found at the White Rocks in Middletown. WM. NORTH RICE.

Wesleyan university, Middletown, Conn.
June 9, 1883.

Book reviews.

I wish to quarrel a little with the critic of Gage's 'Elements of physics' in your issue of June 8, p. 517, for not keeping the following promise, found in the 'Prospectus of SCIENCE for 1883:' "To promote one of its chief objects, and as a distinctive feature of the journal, SCIENCE will give its hearty support to those who are endeavoring to introduce the study of the natural and physical sciences into public and private schools, by drawing attention in every possible way to the high importance of this measure, as well as by giving illustrated articles, plainly worded, prepared by skilful hands, to guide the efforts of the teachers." He has failed to keep this promise by failing to give such information about the book he reviews as "those who are endeavoring to introduce the study of physical science into public and private schools" would like to have. Many teachers cannot afford to buy every text-book they see advertised, and therefore must needs trust to reviews to tell them enough of a book to enable them to decide whether it is worth purchasing. In regard to a work on physics, they wish some such questions as the following answered : —

1. What is the plan of the book ? Does the author expect the pupils to do experimental work, or that the teacher only will perform experiments ? 2. If the author wrote with the view of having experiments performed by the pupils, how well has he succeeded in executing his plan ? Has he succeeded in giving such experiments as will be of real service in laying the foundation of scientific work, and as can be performed in the short time that teachers in high schools and academies have for such work ? Could pupils manage the experiments without the aid of a teacher ? 3. Does the author give any directions in regard to preparing apparatus ? If so, are these directions sufficiently exact and minute to enable an inexperienced person to follow them without trouble ?

All of these questions a teacher would like to find answered in the review of a new book on physics. All the information he would get on these points from the review of Gage's book is found in this sentence: "The book is of merit as giving many experiments with apparatus of easy make." The reviewer said more than this, of course; but this one sentence is all to answer such questions as I have asked above. He was probably right in what he did say, which makes it the more to be regretted that he did not go farther. My quarrel with him is, that he did not say enough; that he did not say as much as your readers had a right to expect, — certainly not enough for those readers who had not seen the book, and wished to know whether it was worth buying. This suggests a question. Are reviews written for the benefit of

those that have made the acquaintance of a book, or for those that have not? For myself, I can answer that I care most for the reviews of those books that I have not seen. In conclusion, I wish to say that Mr. Gage is a stranger to me, and I have never had any sort of communication with him. Whatever one might say in his behalf, my remarks were not made for his benefit, but to point out what I believe to be one of the first duties of the reviewer of a scientific book to his readers. S. T. M.

Lexington, Va., June 13.

[The limited space at our command will not allow of extended analyses of the many text-books of science which are continually appearing. A short notice either of their general merit or demerit is all we can give. In the case of Gage's 'Elements of physics,' the reviewer used the book as a text to preach against the common custom of teachers in using the atomic theory in their explanations as if we knew definitely that atoms exist.]

Solar constant.

Prof. C. A. Young has kindly called my attention to an unintentional oversight in my article entitled 'Solar constant' (SCIENCE, p. 542). In the general equation sent me by him, t represents 'degrees of heat,' not 'quantity of heat;' and m represents 'time,' not 'unit of time.' H. A. HAZEN.

A zoo-philological problem.

On the New-England coast, where Mya arenaria is abundant, and known as the 'clam,' an annelid which is common in the same localities is called the 'he-clam,' and is believed by many fishermen to be the male of the mollusk.

In Norway, Mya arenaria is abundant in the fiords of the north. It has no economic uses; but its associate, an annelid, the 'pür' (said to be Arenicola piscatorum), is an important bait, and gives its name to the Mya which is called the 'pürschaal.'

Why should the common annelid and the common mollusk be thus associated in popular nomenclature in remote regions? It is interesting to observe that the form possessing commercial value in each instance gives its name to the one which is in lower esteem. G. BROWN GOODE.

The sun's radiation and geological climate.

In my objecting (SCIENCE, p. 395) to the assumption that the dissipation of solar energy from loss of heat diminishes the supply of sun-heat received by the earth, I said, that, so far as there has been any change in the supply, it has been in the direction of an increase, and hence cannot explain the undoubted decrease in the temperature of the earth's atmosphere. I think Professor Le Conte's criticism (SCIENCE, p. 543), taken in its entirety, corroborates my position. He shows that the quantity of heat incident normally on a unit of surface in a unit of time varies as the area of a great circle of the sun × heat-emitting power of each physical point of the sun: hence the quantity emitted would not increase, unless the heat-emitting power increased faster than the square of the temperature. He adds that "some physicists (Rossetti) make the latter proportional to the square of the absolute temperature, while others (Stephan) make it as high as the fourth power." If Rossetti is right, there has been no decrease in the amount of solar heat received; while, if Stephan is right, there has been a very great increase: for, on the assumption that the temperature is inversely as the radius, as stated in Professor Newcomb's article (Popular astronomy, p. 508), the heat-emitting power, if the solar radius is reduced to one-half, will be increased four times, and will just compensate for the great circle being reduced four times in area. If the emissive power increases, as Stephan claims, then a doubled temperature will increase it sixteen times, and, the area being diminished only to one-fourth, the earth will receive quadruple the heat.

It is true that the heat-emitting power of any (solid) body varies according to the area of its surface, providing all the other conditions are unchanged. In case of solids and liquids, very little change can be made in their density by any force that we can apply, — so little, indeed, that no appreciable effect can be produced; but gases are easily affected, and there is no difficulty in conceiving them reduced many times in bulk. Now, suppose two spheres, e.g., of hydrogen, of equal masses and of the same temperature, but one having twice the radius of the other. They will radiate equal amounts in equal times, as I shall try to show. I assume that the radiation goes on only from points of matter, — the atoms of the hydrogen. Conceive each sphere made up of a vast number of concentric layers, each one molecule thick. The number of layers will be the same, and the number of molecules in each will also be the same: consequently the heat-emission of the outside layer will be the same in both spheres. What would be true of the first layer would be true of all, unless the outer one intercepts some of the rays. So far as the outer layer is gaseous and elementary (it is very doubtful whether any chemical compounds can exist in the intense heat of the sun), it is a vacuum to radiant heat; for Professor Tyndall, in 'Heat considered as a mode of motion,' has shown (p. 362) this in reference to oxygen, hydrogen, nitrogen, and air, and, in general (see rest of the lecture), that elementary gases or vapors produce little or no effect upon the radiant heat that passes through them. It must be remembered, too, that the source of heat employed in his experiments was icy-cold in comparison with the sun, and that the penetrating power of heat-rays increases as the temperature of their source rises. It is therefore probable that the heat from the lower layers passes through the upper ones, so far as they are gaseous, with little or no loss, and hence that in gaseous bodies the heat-emitting power for any given temperature is proportional, not to the surface, but to the mass or density.

But suppose that diffused through the upper layers were molecules that were capable of stopping every ray that impinged upon them. Neither the absolute number nor the size of these bodies would be affected by shortening the radius, but only the space between them. If the radius were reduced to one-half, the apertures would be reduced in area to one-fourth, while the radiating molecules within any given distance would be increased eightfold: in other words, the chances of not passing out into space would be increased only four times, while the number of shots would be increased eight times; so that, in this case, the heat-emissive power would be actually increased by the condensation. If to this be added an increase of the same power from the rise of temperature (either as the square or the fourth power, *Rosetti* or *Stephan*), there can, I think, be no doubt that any change which has occurred in the earth's temperature from the sun's losing energy has not been in the direction of growing cooler.

As a corollary of the above, I add, the radiant or heat-emitting power of a sphere of gas appears to be a function of mass and temperature, and not of surface and temperature.

This is of interest in the study of cosmic development. C. B. WARRING.

Poughkeepsie, N.Y., June 16, 1883.

Flight of the flying-fish.

The difficulties in the way of accurate observation of the flying-fish in motion are numerous and real. Seen always from above, usually at a distance which is constantly increasing, and while the observer himself is in rapid motion, it is not strange that such conflicting opinions exist, or that the mode of flight is so often spoken of as a mystery.

During a trip by steamer from New York to Rio Janeiro *viâ* the West Indies and Pará, and on the return trip coming directly from Rio to New York, I watched flying-fish nearly every day, and frequently all day, and satisfied myself on the following points: —

The fish usually leaps clear of the water at once, leaving it commonly at an angle of 45° or less. After leaving the water, no forward impulse whatever is received (except sometimes from the wind) until the water is again touched, when the tail may be used effectively without immersion of the rest of the body. Very soon after leaving the water, yet not instantly, the pectorals are spread, and an instant later the ventrals.

Both sets of fins are kept *quietly* extended so far as any *voluntary* vibration is concerned. Any similar, tensely stretched membrane would quiver more or less when cutting the air at such speed.

Ordinarily the two pectorals lie in about the same plane. They are never carried much below the body, but are frequently lifted considerably above it, especially when going before the wind, at which time the whole fish rolls from side to side, precisely as does a sailing-vessel under similar circumstances. The course may be a simple curve, as it commonly is in calm weather, or it may be undulating, as is usually the case in rough weather or over a heavy swell. I think the ventrals are used to direct the fish up or down, as they certainly work independently of the pectorals, and closing them would naturally drop the tail. Toward the close of the first stretch, and when the fish wishes to re-enter the water, the pectorals are instantly closed, and he shoots head foremost into the water with only a slight splash.

If, on the contrary, he wishes to continue in the air, the long lower lobe of the tail is allowed to drop into the water, and a few vigorous strokes send him upward and forward, sometimes enabling him to clear another hundred feet before repeating the action, which I have seen him do at least seven or eight times before finally entering the water for a fresh start.

Not unfrequently the tail is dropped, seemingly by closing the ventrals, and an undulating motion so obtained, even when there are no waves or swells to be cleared; and, although the tail may not then touch the surface, it looks as if the fish were *feeling* for the water, which I think is really the case. The poetic wetting of the wings in the crest of a wave so as to prolong the flight appears to be a harmless bit of imagination for all but the fish: to him it is disastrous. His tail alone needs wetting; and, when by mistake he takes the top of a wave bodily, it usually topples him over, or at least checks him noticeably. The drying of the wings would be rather favorable than otherwise.

I was not able to detect any voluntary change of direction to right or left while in the air.

Once a large fish rose quite close to us, and started directly toward the steamer. When within a few yards, he suddenly closed his pectorals, plunged into the water, and almost instantly issued again in a nearly opposite direction.

Examination of a Pacific species in alcohol (and I presume the same general structure holds good for the genus) shows that the pectorals are inserted at such an angle with the axis of the body, that, if the body be horizontal and in motion, the air striking on their lower surfaces must tend to raise the fish, although at the expense of a certain amount of forward motion. Evidently, then, any beating of the pectorals would only retard the fish still more, even if it did support him somewhat in the air. The conclusion seems inevitable, however, that the tail alone is the propeller, the other fins acting solely and passively as supporters. WALTER B. BARROWS.

Wesleyan university, Middletown, Conn.

HEITZMANN'S MICROSCOPICAL MORPHOLOGY.

Microscopical morphology of the animal body in health and disease. By C. HEITZMANN, M.D. New York, *J. H. Vail & Co.*, 1883. 19+849 p. 8°.

DR. HEITZMANN, formerly of Vienna, now of New York, is well known as an unusually good histological draughtsman. Ten years ago he published some investigations on the minute structure of protoplasm. To his own researches on this subject he has long attributed an importance which scientific men of much greater experience and ability have failed to recognize. The present volume, a very well made and beautifully illustrated book, although it comes in the guise of a manual of normal and pathological histology, is obviously intended principally to bring forward the author's own theories, and to insist upon their fundamental character and great value.

The author so openly implies his conviction that he is a neglected grandeur, that he incites the critic to a severity of comment that a tone of modesty more commensurate with the real value of his researches would not have called forth. The general defect of the book is want of judgment on the author's part, and an exaggerated confidence in his own notions. Thus, being unusually skilful with his fingers, he scoffs at microtomes (p. 7), and closes a slurring paragraph upon them with, "The greater the complication, the less is the value of such machines." A man who makes such a statement without any limitation reveals a hopeless lack of comprehension of the indispensable requirements of many branches of histological investigation. The second chapter in the book discusses the general properties of living matter, and contains a number of characteristic loose assertions: for instance, "Life is evidently a peculiar kind of motion of the molecules (plastidules) of living matter, of a relatively short duration" (p. 14). This is

simply a false statement, since the utmost that could be said is, that unknown molecular changes occur in living organisms. There is no basis for saying that life is 'a peculiar kind of motion,' much less that it is evidently so.

The pages from 20 to 142 are essentially an extended exposition of the author's theories in regard to cells and protoplasm, which he groups under the general term of 'the bioplasson doctrine.' He maintains that all protoplasm is a network, that the nucleus is only a part of the network, and that the network of the so-called 'cells' is really continuous, the whole body forming one mesh. The cells are not distinct elements, but only partially differentiated centres of the mesh: he drops the term 'cell' altogether. He very complacently explains that he has revolutionized the generalizations of all histologists before him, but admits that he expects recognition only from the future. "The present generation of histologists will very probably never realize the harm done by the misnomer 'cell,' etc." (p. 57).

Unfortunately, Heitzmann has entirely overlooked the extremely obvious reasons for rejecting his bioplasson doctrine. He mentions (p. 134) the independent cells, which migrate within the body, but merely remarks that their occurrence 'does not alter the general rule.' If he had been acquainted with the work of the last few years by Fleming, His, Hatschek, and many others, upon the development of tissues, he would have known that a great many of them are derived from just such independent cells, forming a natural group, for which the brothers Hertwig have proposed the name 'mesenchyma.' The existence of these tissues alone suffices to overthrow the theory of a continuous protoplasmatic network as the basis of organic structure. Further, he has overlooked that during segmentation of the ovum a complete separation of the cells is effected: hence it is self-evident, that, even if the network of adjacent cells is found to be continuous in later life, such a disposition is secondary, and cannot, therefore, possess the fundamental significance our author has assigned to it.

As the part, so is the whole, with numerous defects from want of judgment or wider knowledge, and blemishes from want of modesty. The largest part of the volume is taken up with accounts of the various tissues and organs and the pathological changes in them. There is little sense of proportion, — eight pages are given to the cornea, but only one-third of a page to all the sense organs; sixty-three pages to the teeth, and barely two to the development of nervous tissue. If he is to be judged by those two pages, we must assume the author to be entirely unacquainted with the literature of his subject, and to have made no accurate original observations. Indeed, throughout the volume the attention bestowed on recent histological literature is so meagre that it impresses us as an intentional and convenient neglect, rather than as the outcome of ignorance and oversight.

The unequal attention given to different topics renders it impossible to regard the volume as a text-book, although it imitates the form of one. It is really a series of special arguments, or, to speak more accurately, of bare assertions, to prove that the bioplasson doctrine is true of certain tissues. This attempt would be excellent in a series of scientific articles which discussed the doctrine by accurately stating careful and exact observations, and judiciously considering the objections. The author, however, ignores even these elementary requirements of logical argument. On the contrary, as is not unusual with persons of narrow views, he is excessively dogmatic. Of a rigorous scientific demonstration there is only pretence.

Besides the main text, there are numerous contributions in fine print by twenty other writers, whose articles nearly all partake of the singularities of the chief portion of the work.

Those descriptions which do not touch upon the bioplasson doctrine, but merely recite the elements of histology, such as they may be found in numerous text-books, are more accurate than the rest. The style of the book is good, clear, and simple. The presentation of the subject-matter is well arranged and natural. Many of the illustrations are excellent, some could hardly be improved, and all are good in point of technical execution. A large proportion are said to represent the bioplasson network in various tissues: of those that are purely diagrammatic, it can only be said that they are pictorial theories; those, however, which are stated to be drawn from the tissues, represent an organization which we cannot admit to be actual, — a number of spherical granules of nearly even size, and at even distances from one another, connected together by threads of uniform diameter. We believe that figs. 10, 32, 66, 114, 120, and others, showing this pattern of globules and linking threads, have their prototype in the author's imagination, which has distorted the actual

appearance of the protoplasmatic network of cells. If these appearances are real, Dr. Heitzmann's best plan of securing recognition for his views would be to send preparations to be examined by histologists of experience in research. The discovery of the reticular character of protoplasm is very interesting, and our author deserves praise for insisting on this point; but we find in his volume little to awaken the expectation that it will earn recognition for the 'bioplasson doctrine;' which, in our opinion, is not shown to deserve serious consideration, although it is possible or even probable that in certain cases a secondary connection is established between the protoplasm of adjacent cells.

It should be added that special consideration of the pathological chapters has been purposely omitted from this notice as inappropriate here.

EUROPEAN ORTHOPTERA.

Prodromus der europäischen Orthoptera. Von C. BRUNNER VON WATTENWYL. Leipzig, *Engelmann*, 1882. 32, 466 p., 11 pl., map. 8°.

THE activity of systematists within the past thirty years has rarely received a more striking proof than in the publication of the volume before us. When H. Fischer published his classic work on European Orthoptera, the number of recognized species on that continent was less than two hundred and fifty. Brunner, one of our leading writers, now places the number at very nearly double the former figure. The increase is particularly marked in the Locustariae, which have nearly trebled.[1] Already, while Fischer's work was passing through the press, Fieber was making discoveries in the little worked region of south-eastern Europe; and, of late years, Bolivar and others have shown how little the Iberian peninsula was known; yet one would scarcely have looked for such striking additions in so old a field as Europe, and among such bulky insects as the Orthoptera.

Meanwhile there has been great activity in the study of Orthoptera of other parts of the world; and it may safely be said, that, if the number of European Orthoptera has doubled, that of the world at large has quadrupled in the same period. This has entailed much revision and remodelling, in the work of which Brunner, Saussure, and the gifted and lamented Stål, have performed the most honorable part, though they may have been outdone in (diluted) quantity by Walker.

There was need, then, that some one should crystallize the methods of recent days for a region so abounding in workers as Europe. This Brunner has now attempted.

He disclaims at the outset any attempt at a monograph. Europe, he rightly says, is no natural province, and the Orthoptera, in the sense of the older naturalists as used in his work, no natural order. For the convenience only of the numerous workers in this region upon the somewhat heterogeneous groups which have been classed under Orthoptera, he issues this Prodromus. It is excellent as a systematic review. The groups are clearly and succinctly defined, but the work is mainly of value in a faunal sense. There is no superfluity of language; analytical tables abound; the balance of parts is admirable; every genus is well illustrated; and, as an expression and synthesis of current toxonomic views, it will serve a most useful purpose. But the biology of these insects is entirely and purposely overlooked; and there is yet room for some one, working upon the excellent model of Fischer, but with the light the newer biological studies have given, to produce a work which shall be classical, and far more fruitful than this can be.

MACHINERY AT PARIS, 1878.

Rapports du jury international, groupe VI., classe 54: Les machines et les appareils de la mécanique générale. Par M. HIRSCH, ingénieur des ponts et chaussées. Paris, *Imprimerie nationale*, 1883. 8°.

M. HIRSCH has collated and edited the notes of the members of the section of the jury of which he was secretary, and compiled a very extensive and detailed report, with the addition of considerable matter original with himself, thus making a valuable work of the official report. The principal classes of exhibits here examined are steam engines and boilers, with their accessories (divided into stationary and locomotive engines and portable machines), hot-air engines, electric and other motors, hydraulic machinery, compressed-air apparatus, machinery of transmission, machinery of transportation, dynamometers, and miscellaneous parts of machinery. There seem to have been no steam-boilers or accessories from the United States except the Hancock inspirator, which is well noticed. The engines of Corliss and Wheelock are studied at length, and apparently with very satisfactory results, the latter taking the *grande médaille*. A large number of engines were exhibited, — copies of the American Corliss engine, which has evidently

[1] Brunner credits Ephippigera with forty-nine species, of which only ten are given by Fischer. The additions are largely from Bolivar's work in Spain.

become the best standard among European makers.

Among the hot-air engines, that of Rider is given a leading place, and is fully described. It is commended for its simplicity, its quietness in action, its regularity, and its careful design.

Stow's flexible shafting is noticed as one of the characteristic products of American ingenuity. It consists of two oppositely twisted helices of steel wire, the one enclosing the other, and both covered with a flexible sheath. The device is recommended for the transmission of motion around a corner. These American exhibits were all properly commended in the award of premiums by the jury.

Among other important exhibits from European countries were various forms of 'safety-boilers;' the singular modification of the injector of Giffard, which, by means of the energy of the exhaust-steam, performs the functions of the air-pump in the steam-engine; several forms of compound engine; Hall's pulsometer, which is a modification of the Savery steam-engine of nearly two hundred years ago, with automatically working valves, — an American invention; the gas-engine of Otto, which is said to have exceptional efficiency; the Sagebien vertical water-wheel, which is claimed to have extraordinary performance; the indicator of Deprez, which gives a diagram from the fastest engines; and many other important inventions.

One remarkable feature of the exhibition was the absence of valueless and eccentric devices. This point of difference, in contrasting the exhibition with those which preceded it, is attributed largely to the progress of technical education.

In studying progress, it is noted that the gain is considerable in every direction. In the production of steam, the more general use of 'heaters' of the feed-water is observable, the use of tubular and of the 'safety' forms of boiler is increasing, superheating is oftener practised, better material and workmanship are seen. In steam-engine practice, the use of higher steam, of greater expansion, the adoption of two types exclusively, — the compound of the Wolff type, and the American forms of single-cylinder engines, — greater speed of piston and of rotation, and the use of better material and superior workmanship, are the characteristics of recent practice. Rotary engines are given up. Air and gas engines are extensively used, but only for small powers. Among the hydraulic motors, the turbines are principally used, and have attained great perfection in practice as in theory. Aerostation has made no great progress, notwithstanding the interest which it continually awakens.

American exhibiters distinguished themselves by the boldness and the ingenuity of their designs, and by their entire independence of tradition. Their devices are adapted precisely and effectively to their work. "*Les Américains s'attachaient avec énergie à l'idée première, à l'idée juste; ils l'amélioraient, la perfectionnaient, et, même au prix de grandes complications de méchanisme, ils finissaient par la faire triompher, et par l'imposer de nouveau à l'Europe.*"

MINOR BOOK NOTICES.

Conversion-tables of metric and British or United States weights and measures, with an introduction. By ROBERT H. THURSTON, A.M., C.E. New York, *John Wiley & Sons*, 1883. 83 p. 8°.

IN the introduction, the requirements of any system of weights and measures are given. There is a brief history of the English and French systems, and the supposed advantages of the metric are stated. The difficulties and annoyances arising during the change from the English yard and pound to the metre and gram are suggested as sufficient reason for this book. In the second part, containing the tables of conversion, the units of length, mass, stress, work, and heat, temperature and barometric pressure are defined. A chapter is devoted to C. G. S. units. The tables are full, numerous, and seem to be well arranged, and will, without doubt, be found useful by those having occasion to make measurements. This book forms part of a treatise, in three volumes, on the Materials of engineering, by the same author.

How the great prevailing winds and ocean-currents are produced, and how they affect the temperature and dimensity of lands and seas. By C. A. M. TABER. Boston, *Williams*, 1882. 82 p. 12°.

This pamphlet, by Capt. Taber of Wakefield, Mass., gives a practical seaman's views on the origin of winds and ocean-currents, and suggests certain very hypothetical causes for glacial climate. The fundamental errors of the work lie in a misconception of the sun's action in producing, and the earth's effect in deflecting, the winds, and in a tendency to refer apparently simple effects to single instead of composite causes. The other side of some of the questions here raised is presented in Tchiatcheff's or Rolland's descriptions of the Sahara, and Woeikoff's and Hann's articles on the general atmospheric circulation.

The physiology of protoplasmic motion. By Th. W. ENGELMANN. Translated by C. S. DOLLEY. Rochester, N.Y., *Davis & Leyden, n.d.* 40 p. 8°.

This pamphlet, without date or any statement as to the original, is a good translation, with very poor reproductions of the illustrations, of Engelmann's chapter in Hermann's well-known Handbuch der physiologie. It is to be regretted that the author did not see fit to date his translation, nor give the source of the original. The latter omission we are fortunately able to supply.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Orthogonal transformations. — Mr. W. J. C. Sharp has investigated the invariants of a certain orthogonal transformation with special reference to the theory of the strains and stresses of an elastic solid. If a, b, c, f, g, h, are transformed according to the same law as $x^2, y^2, z^2, yz, zx, xy$ (x, y, z, being the rectangular Cartesian co-ordinates of a point, transformed without change of origin), they will have a system of invariants entirely unaffected by the transformation. The author gives the three invariants corresponding to these quantities, and makes a large number of exceedingly interesting applications to different geometrical and physical problems. As Mr. Sharp's paper consists almost entirely of algebraical work, it is impossible to give it more than this brief reference, and to commend it to the notice of those interested in the subjects which he touches upon. — (*Proc. Lond. math. soc.*, xiii.) T. C. [1137

Elliptic functions. — The Rev. M. M. U. Wilkinson has given a number of general formulae arising from the differentiation of the elliptic functions with respect to the modulus. — (*Proc. Lond. math. soc.*, xiii.) T. C. [1138

Unicursal twisted quartics. — Mr. R. A. Roberts considers in this paper some properties of the unicursal twisted quartic curve; namely, the intersection of a quadric and a cubic which contains two non-intersecting generators of the quadric. Almost exclusive use is made of the expressions for the co-ordinates of a point on the curve in terms of one independent parameter. A reduction is first given to the canonical form, and, after examining a particular property of the curve, the author obtains the condition that four points of the curve shall be complanar; then certain points on the curve are examined, and invariant conditions are obtained for degenerate forms of the curve. The next five sections treat of polygons circumscribed about the curve, and the five concluding sections treat of circular unicursal quartics. — (*Proc. Lond. math. soc.*, xiv.) T. C. [1139

PHYSICS.

Acoustics.

Maintained vibrations. — Lord Rayleigh discusses mathematically that type of maintained vibration which is most familiar in the form of Melde's experiment in which a fine string is kept in transverse vibration by connecting it at one end with one prong of a vibrating tuning-fork, the direction of the motion of the point of attachment being parallel to the length of the string. The string settles into a state of permanent vibration whose period is double that of the point of attachment. The equations indicate that an absolutely rigorous adjustment of pitch is necessary, a conclusion not borne out by experiment. This is accounted for by the slight variation of rate with variation of amplitude. The *son rauque* of Savart is probably caused in a similar way, as the periodic variations of tension accompanying longitudinal vibrations will produce associated transverse vibrations. For lecture illustration, a soft-iron pendulum vibrating on knife-edges may be placed vertically over a vertical bar electro-magnet, through which are sent intermittent currents whose frequency is twice that of the pendulum vibrations. Of the same nature are the crispations observed by Faraday on the surface of water which oscillates vertically. The author has shown that Faraday was correct in his opinion that there are two vibrations of the support for each vibration of the liquid. — (*Phil. mag.*, April.) C. R. C. [1140

Hydrogen-whistles. — Le Conte calls attention to an error in Galton's calculations, as he assumes that the number of vibrations of the whistle, when blown with different gases, is in proportion to the density, while it is actually in proportion to the square root of the density. Hence 86,533 instead of 312,000 vibrations would be given by Mr. Galton's proposed whistle. — (*Nature*, May 17.) C. R. C. [1141

Electricity.

Winding electro-magnets. — Professors Perry and Ayrton have experimented upon the following types of electro-magnets: —

1. Wires wound equally over the whole length.
2. Wires coned toward each end.
3. Wire wound equally over half the iron bar, leaving the other end bare.
4. Wire wound on one half, but coned towards the end.

It was found that the effect of coning the wire is to produce a strong field very near the pole, but that the force falls off very rapidly as the distance from the pole increases. At considerable distances from the end of the electro-magnet the uniformly coiled magnet, No. 1, produces the most powerful field. At very small distances from the end of the magnet, Nos. 3 and 4 give the strongest effects. They conclude therefrom, that with a definite length of wire, of core, and strength of current, the mode of coiling the wire determines the strength of the magnetic field at different distances from the end of the electro-magnet. — (*Phil. mag.*, June, 397.) J. T. [1142

CHEMISTRY.

(*Analytical.*)

Ammonic hyposulphite as a reagent in qualitative analysis. — A. Orlowsky suggests the use of ammonic hyposulphite instead of hydric sulphide in a qualitative separation of the metals. In a systematic course of analysis which Orlowsky proposes, lead, barium, strontium, and calcium are precipitated

with ammonic sulphate. The filtrate is acidified with hydrochloric acid, heated to boiling, and sodic or ammonic hyposulphite added, avoiding an excess. The precipitate, which contains antimony, arsenic, tin, platinum, mercury, silver, copper, bismuth, cobalt, and nickel, is next treated with ammonic sulphide. On neutralizing with ammonia the filtrate from the precipitate thrown down by the hyposulphite, cadmium, manganese, and zinc are precipitated. In the last filtrate the alkalies, calcium and magnesium, must be looked for, as well as antimony and tin, since the last two metals are not precipitated completely by ammonic hyposulphite. — (*Journ. russ. phys. chem. gesellsch.*, 1883, 82; *Berichte deutsch. chem. gesellsch.*, xvi. 807.) C. F. M. [1143

Separation of nickel from cobalt. — For the detection of a small quantity of nickel in presence of much cobalt, or of a trace of cobalt with nickel in large quantity, G. Vortman converts the cobalt into the luteo-salt by oxidation with sodic hyposulphite in an ammoniacal solution. Nickel may be precipitated from this solution by sodic hydrate, and, in the filtrate, cobalt by ammonic sulphide. — (*Monats. chemie*, 4, 1, *Berichte deutsch. chem. gesellsch.*, xvi. 810.) C. F. M. [1144

Determination of zinc as sulphide. — In igniting zinc sulphide, R. Macarthur suspends the crucible containing the sulphide in a Hessian crucible with a hole drilled through the bottom large enough to admit the flame of a Bunsen burner. Another hole is drilled through the side of the crucible, through which is passed a glass tube for introducing a stream of hydric sulphide. — (*Chem. news*, xliv. 159.) C. F. M. [1145

METALLURGY.

Copper-smelting plant. — The Pacific copper-smelter has a peculiar arrangement of the water-jacket. By means of circulating plates, a rapid circulation of the water is secured, and also great economy in the use of water. The thirty-ton smelter requires about twenty-five thousand gallons of water per day, if allowed to run to waste; if collected and cooled for use again, only about three thousand gallons are needed. — (*Min. sc. press*, April 28.) R. H. R. [1146

The dephosphorization of pig iron. — The following is the process for which a patent was granted, May 22, to Mr. James Henderson of Bellefonte, Penn. The iron is taken from the Bessemer converter at the end of what is called the third period, or after the boil, transferred by means of a ladle to the hearth of a reverberatory furnace, which is capable of being heated to the melting-point of wrought iron or higher. The metal is treated in this furnace with fluorspar and titaniferous iron in the proportion of forty parts by weight of fluorspar to one hundred of titaniferous iron. If there is one per cent of phosphorus in the metal, about three hundredweight of the mixture will be required to a ton of steel. Thus the dephosphorization is effected after the decarbonization. — (*Eng. min. journ.*, May 26.) R. H. R. [1147

The basic process at Steeltown. — The first heat of basic steel ever made in this country was effected on May 7, 1883, at Steeltown, by the Pennsylvania steel company. The excellent quality of the steel thus made is shown by the following tests. Some flat bars were plunged in water when hot, and then bent cold and hammered down without showing any fracture. A plate was also flanged hot, on which the flange is as perfect as if the material had been the best charcoal-hammered plate iron. In the same plate two holes were punched within a sixteenth of an inch of each other without cracking the intervening steel. — (*Bull. Amer. iron steel assoc.*, May.) R. H. R. [1148

Blast-furnace slag. — It is now proposed by Mr. A. D. Elbers of Hoboken, N.J., to utilize the well-known mineral wool for the manufacture of china cement, pigments and absorbents. The process consists in roasting and subsequent washing of the fine mineral wool so as to leave only the silicates of lime, alumina, and magnesia. — (*Eng. min. journ.*, May 26.) R. H. R. [1149

The Siemens direct process. — A lot of separated magnetic iron sand from Moisic, Canada, was sent to Mr. James Davis, manager of the New steel-works, London, to be worked in the Siemens direct rotatory furnace. Mr. Davis reports that it is the best material for working in the rotator that he has seen. A charge of twenty-five hundredweight with six hundredweight of coal or charcoal gave the best results. The average time required was three hours forty-five minutes, and the yield of solid metallic balls was fifteen hundredweight three quarters. The balls were found very suitable for making mild steel in the Siemens furnace. The wages are estimated at five shillings per ton of balls; the fuel, at ton per ton. — (*Eng. min. journ.*, May 5.) R. H. R. [1150

GEOLOGY.

Geology of the province of Jujuy, Argentine Confederation. — Brackebusch divides the formations of this province as follows. 1°. Sedimentary rocks: *a.* Silurian, *b.* cretaceous, *c.* post tertiary, *d.* modern. 2°. Eruptive rocks: *a.* granite, *b.* quartz prophyry, *c.* diorite, *d.* basalt, *e.* tragnite and andesite. The Silurian consists of two members, — the primordial (Taconic) fauna, being represented in a great thickness of beds, and the second or lower Silurian fauna.

The petroleum-bearing formation has been assigned to almost every geological period. The present author considers it as probably lower cretaceous, and makes a fair argument in support of his claim. Darwin considered it as cretaceo-Jurassic. These beds have an enormous distribution in South America. The same beds are said to reach to Puntas Arenas, where Dr. G. Steinmann (SCIENCE, p. 156) has lately recognized the neocomian, which would seem to support the view that they are of lower cretaceous age. Brackebusch thinks that the boring of wells for petroleum in the region he has examined will be attended with magnificent results.

In the quartz porphyries, many ores of copper and argentiferous galenite occur. The trachytes and andesites, and their accompanying tufas, are very widely distributed. To these the author refers numerous gold and silver mines of the province. — (*Anal. soc. cient. argent.*, 1883.) J. B. M. [1151

Lithology.

Fossil-bearing schists. — Renard has published a valuable paper on the metamorphic rocks of the Ardennes, in which fossils had been found by Dumont and Sandberger, the latter describing a case in which garnets and fossils were together in the same hand specimen.

The fossils Spirifer macropterus and Chonetes sarcinulatus show that the schists belong to the lower Devonian. The paper gives the results of microscopic and chemical analyses, describing the principal minerals. Renard rejects entirely the view that these schists are chemical precipitates, and holds that they are metamorphosed sediments.

These results are similar to those of Reusch and

Brögger on the schists of Norway. Both found fossils in crystalline marble, in mica schist, and in other rocks of like metamorphic character. The latter even found the remains of Orthis enclosed in dodecahedral garnet. Likewise the Carrara marble of Italy has been shown to overlie and underlie fossiliferous strata. From these observations, there seems to be no doubt that the general belief that schists are metamorphosed sedimentary rocks is substantiated, so far as these regions are concerned; and they afford no aid to the revived and remodelled Wernerian hypothesis that has been made so prominent in this country during recent years. Without objecting to the work of the writers above referred to, attention may be called to the tendency in most observers, when they have proved the origin of a rock, to assume that all associated rocks are the same, leading one class to hold to the eruptive origin of all the rocks seen, and another to their sedimentary origin. In regions of crystalline rocks, both classes of rocks would naturally be expected to occur together, and it would be well if the utmost care should be used to prove the origin of every rock in the district studied. — (*Bull. mus. roy. Belg.*, i.; *Die silur. etagen* 2 *u.* 3; *Silurfoss. og kongl. i Bergensk.*; *Nature*, xxvi. 567, xxvii. 121.) M. E. W. [1152

Carboniferous gneiss and schist. — Some gneisses and schists, which, from the associated plant-remains, are referred to the carboniferous, have been microscopically studied by Foullon. They are associated with the graphite deposits about Kaisereberg in Steiermark. The gneiss is composed of felspar (albite) quartz, muscovite, and chlorite, with a little epidote, biotite, and, in one case, tourmaline. The phyllite gneiss is fine-grained, and composed of quartz, orthoclase (microcline), and tourmaline; while the graphitic schist is also a purely crystalline mass of quartz and chloritoid, excepting some portions in which are found plant-impressions and plates of a micaceous mineral. Zircon and an asbestiform mineral were also seen. — (*Verh. geol. reichsanst.*, Jan., 1883.) M. E. W. [1153

MINERALOGY.

Some results of the alteration of minerals. — The following facts are communicated by F. A. Genth: —

Albite from orthoclase. — This interesting alteration is well exhibited at the gneiss-quarries of upper Avondale, Penn., where flesh-colored orthoclase is found much decomposed, the cavities being filled with albite associated with muscovite.

Anthophyllite from talc. — At Castle Rock, Delaware county, Penn., talc occurs as the result of the alteration of olivine, but in some cases this alteration has proceeded farther. Radiating from a nucleus of talc is a white or grayish mineral, with silky lustre and prismatic cleavage at an obtuse angle, which proved, upon analysis, to be anthophyllite.

Talc pseudomorph after magnetite. — In Hartford county, Md., small octahedrons of scaly talc occur, the scales being parallel to the octahedral faces; and sometimes the crystals contain in the interior a small nucleus of magnetite. The author regards the crystals as pseudomorphs after magnetite, and suggests that a whole bed of steatite twelve to fifteen feet in thickness, occurring at the above-mentioned place, may have resulted from a like change from magnetite. — (*Proc. Amer. phil. soc.*, xx. 392.) S. L. P. [1154

Wulfenite. — It has generally been accepted that the red varieties of wulfenite found at many localities are colored by chromate of lead ($PbCrO_4$), which is isomorphous with the wulfenite $PbMoO_4$. If this is true, lead chromate must be tetragonal in its crystallization, and trimorphic; for the natural variety, crocoite, is monoclinic, and again it is undoubtedly orthorhombic, isomorphous with anglesite ($PbSO_4$). In red crystals from Phoenixville, Penn., J. Lawrence Smith found vanadium and only a trace of chromium, while Wöhler detected vanadium in a variety from Bleiberg in Carinthia. Owing to the dissimilarity between molybdic and vanadic acids, it is not probable that any isomorphism exists between them, while chromate and molybdate of lead, from a chemical stand-point, can well be regarded as isomorphous. To decide as to the true nature of the coloring-matter, P. Groth had various wulfenites examined by F. Jost, with the following results. In a highly colored, yellowish-red variety from Bleiberg, neither chromium nor vanadium could be detected. In the red crystals from Phoenixville, Penn., chromium was found, but no trace of vanadium. The analysis gave

$$PbO(60) + MoO_3(39.21) + CrO_3(0.38) = 99.59.$$

The green pyromorphite accompanying wulfenite from the latter locality contained no vanadium, but a trace of chromium; while chromium was also found in a yellowish-red pyromorphite from Leadhills, Scotland. Here, certainly, no isomorphism can exist between the chromate and phosphate of lead; and the red color in the latter case must be due either to the mechanical admixture of some chromate or some pigment entirely independent of the chromium. The fact that wulfenites, entirely free from and containing a trace of chromium, occur of a red color, makes it probable that the color is due to some pigment, perhaps of organic origin, while the chromate is present as a mechanical admixture, and in no way related to the red color. — (*Zeitschr. kryst.*, vii. 592.) S. L. P. [1155

METEOROLOGY.

Solar physics. — A recent report on this subject to the British government mentions India as a satisfactory field in which to prosecute investigations of solar radiation, and its connection with terrestrial phenomena; calls attention to the importance of a more satisfactory means of measuring directly the sun's heat, the great obstacles presented in the attempt to measure this heat at sea-level stations, owing to the very great fluctuations in the observed direct heat, even on clear days, due to invisible vapor; and refers to the expedition of Prof. Langley to Mount Whitney, and the permanent establishment of instruments at Leh in India, at an elevation of 11,000 feet, in order to overcome these obstacles if possible. A very useful, detailed catalogue of sun-spot observations, and photographs of the sun, from 1832 to 1877, is given. A discussion of the influence of the state of the sun upon the earth's temperature is entered upon, in which an effort is made to connect the range of temperature at the single station Toronto, Canada, with the sun's spots. The results arrived at seem to show that a maximum temperature range corresponds to a maximum number of spots, and that the Toronto phases of temperature range lag behind similar phases in solar spottedness between one and two days. The first of these conclusions differs from the opinions held by some, and, on taking the mean annual ranges, seems hardly sustained.

The following table gives the mean annual range of temperature from 1841 to 1880, and mean annual cloudiness from 1853 to 1880, at Toronto, Canada. Solar spot numbers are added for comparison.

Mean annual temperature range, } *Toronto, Canada.*
" " *cloudiness,* }
with sun-spot numbers.

Year.	Range.	Cloudiness.	Sun-spots.	Year.	Range.	Cloudiness.	Sun-spots.
	°	%			°	%	
1841	16.8	–	37	1861	14.4	.62	77
1842	17.8	–	24	1862	14.4	.63	59
1843	16.7	–	11	1863	14.7	.61	44
1844	17.9	–	15	1864	14.6	.65	47
1845	17.9	–	40	1865	15.4	.61	31
1846	15.8	–	62	1866	16.0	.61	16
1847	13.9	–	98	1867	15.5	.61	7
1848	14.9	–	124	1868	15.3	.64	37
1849	13.6	–	96	1869	14.6	.66	74
1850	16.7	–	67	1870	15.7	.62	139
1851	13.9	–	65	1871	16.5	.64	111
1852	14.3	–	54	1872	17.6	.59	102
1853	16.9	.57	39	1873	16.9	.60	66
1854	19.8	.59	21	1874	17.4	.63	45
1855	18.2	.60	7	1875	17.4	.62	17
1856	18.3	.57	4	1876	15.7	.66	11
1857	16.4	.60	23	1877	16.2	.60	12
1858	13.9	.60	55	1878	15.1	.62	3
1859	13.7	.61	94	1879	17.1	.63	6
1860	14.2	.60	96	1880	16.0	.62	–

If these figures be projected in curves, it will be seen that minimum ranges occur markedly about 1848 and 1859, while maximum ranges occur about 1844 and 1855; which are just the epochs of maximum and minimum sun-spot numbers respectively. Making full allowance for varying cloudiness, we still do not obtain any different results. The whole subject needs complete investigation. — (*Rep. com. solar phys. London*, 1882.) H. A. H. [1156

Applications of photography to meteorology. — Photography is constantly finding new applications in the other sciences. By its means, under the direction of Capt. Abney, experiments are being conducted at Kew, Eng., to determine the height and velocity of clouds. Two similar cameras are set up at a distance of about six hundred feet apart, and provided with instantaneous shutters, which can be released at the same instant by electricity. By knowing the angle of inclination of the cameras, and measuring the position of the cloud as photographed on the two plates, we at once have a trigonometrical observation which will give us the distance of the cloud with great accuracy. The axis of a cyclone is probably not vertical, its upper portion being in advance of the lower in relation to the direction in which the cyclone is moving: hence the higher clouds are sometimes affected by an approaching storm before its influence affects the winds blowing at the surface of the earth. The cirrus clouds are, therefore, the ones to whose observation is attached the greatest importance. Occasional observations only have so far been made, but the Meteorological council has under consideration the plan of adopting the instrument for continuous use at its central station at Kew. The observations made so far would seem to indicate that the cirrus clouds are not situated at so great an elevation as has heretofore generally been supposed. — (*Brit. journ. phot.*, May 4.) W. H. P. [1157

PHYSICAL GEOGRAPHY.

Old river-courses by Vicenza and Padua. — F. Molon gives geological and historical evidence to show considerable changes in the rivers Astico and Brenta, on the northern margin of the plain of Lombardy, in post-glacial times. On issuing from the mountains, both of these streams formerly turned westward, toward a depression produced by an old fault running along the eastern margin of the hills from Schio to Vicenza; but, as this district was raised by their deposits, they ran more directly south, and now the Astico is laying its sands on the old beds of the Brenta, while the latter has abandoned the channel which led it through or even west of Padua, and flows farther east. By such diversions from old channels, the volume of some of the lower streams has been greatly affected. The name Retrone was formerly applied to a river of considerable size, extending to Padua; but it is now limited to a small stream west of Vicenza. The Bacchiglione, an Italian corruption of the German Bachlein, was named when its size justified its meaning; but it has now usurped the place and volume of the old Retrone. — (*Atti ist. veneto*, i. 1882–83, 247, 347.) W. M. D. [1158

Origin of fiords. — Fr. Ratzel calls attention to the broken form of polar coasts in both hemispheres, and the bare, rocky surface of the adjoining lands, and concludes that both of these characteristics result from the strong erosive action of ice. He lays the excavation of not only our Great Lakes and Onega and Ladoga to the same cause, but the Baltic, the North Sea, and Hudson's Bay as well (*Ausland*, 1883, 223, 254). The barrenness of polar lands may well be ascribed to ice-action, which has undoubtedly produced some modification of the surface as well; but to consider all their diversity of form due to glacial erosion exaggerates the power and duration of the ice as greatly as it neglects other and efficient causes. — W. M. D. [1159

GEOGRAPHY.

(Arctic.)

Northern voyages in the fourteenth century. — Baron Nordenskiöld has begun the publication, under the title of '*Studier och forskningar*,' of a popular scientific account of early voyages to the high north, as a sort of supplement to the 'Voyage of the Vega,' in which so many early northeastward voyages were noticed. The first volume contains an account and discussion of the voyages of the brothers Antonio and Nicolo Zeno of Venice, who are supposed to have journeyed to the Faeroe Islands, Iceland, and East Greenland toward the close of the fourteenth century. The author brings forward reasons for believing that the voyages were actually made, and the narrative authentic, a general disbelief in them having been (with a few individual exceptions) hitherto prevalent. The volume contains a photographic reproduction of the map of Claudius Clavus in 1427, — a remarkable discovery by Nordenskiöld himself, who found it in the city library of Nancy, included in an old manuscript copy of Ptolemy's Cosmographia. The period when all early voyages were regarded with suspicion or open disbelief seems to have passed away, and the truthfulness of some of them is established; while the misapplication of others (as the Chinese voyages to Fu-sang, now known to be a province of Japan, but formerly interpreted by enthusiastic geographers as north-west America) has been rectified. The danger of running into the opposite extreme of credulity is not, however, to be overlooked, in view of the attention which the perfectly preposterous story of 'Moncatch-Apé' has recently received from a few serious students. It is not necessary to say to any ethnologist who understands the nature of the races of north-west America as they were when discovered, that the story referred to is not less improbable than the wildest vagaries of Jules Verne. — W. H. D. [1160

Nordenskiöld's programme. — Baron Nordenskiöld's programme for this year's expedition is published in full by the concurrence of Mr. Oscar Dickson, who provides the funds to carry it out. Besides the object of penetrating to the interior of Greenland, it is hoped to fix the limits of the drift-ice between Iceland and Greenland, to sound and dredge in the adjacent seas, to pay especial attention to the flora of the ice and snow, to further investigate the plant-remains in the fossiliferous strata of the region visited, and to collect new data connected with the fall of cosmic dust. The expedition sailed from Gothenburg in the latter part of May, and expects to start on its return in September next. — (*Nature*, May 10.) W. H. D. [1161

(*Asia.*)

Corea. — J. C. Hall, British consul at Nagasaki, visited Han-yang or Söul (Seul), the capital of Corea, last October. In approaching the harbor of Nam-yang, the west coast was found hedged in by a thickly clustered fringe of islands, through which the mainland could hardly be seen. The water was very shallow; and the heavy fall of the tides, averaging thirty feet, makes dangerous currents. Thousands of square miles of mud flats are left bare at low water; and, besides all these difficulties, there are the dense fogs of summer, and shore ice of winter. The coast is bold, rising in trap and granite headlands two to six hundred feet high. The interior, as far as seen, was bare and almost treeless. The villages are of miserable mud-hovels, and the people are very poor. The only temples seen were two small huts near a village at the landing-place. Söul is about fifty miles inland; it is a shabby, squalid city of low stone and mud houses, with a population of about 240,000. One long main street one hundred feet wide, running east and west, and another about north and south, divide it into nearly equal portions, and lead to gates in the eastern, southern, and western walls. On the northern side it is enclosed by steep granitic peaks. Below their abrupt slope is the royal enclosure, containing the king's palace and the more important public buildings. Mr. Hall learned from the Japanese consul that the population of the kingdom, according to the government census, was about 6,840,000 souls. The revenue is derived from a tax on the cultivated land, and is payable either in money or in produce: at present it amounts to about 190,000 pounds sterling. — (*Proc. roy. geogr. soc.*, v. 1883, 274.) W. M. D. [1162

Upper Siam. — Between Nov. 9, 1881, and June 14, 1882, Carl Bock, whose travels in Borneo are already well known, made a journey from Bangkok up the valley of the Menam, and across the Lao states to the Mekong River, and back again by much the same route. The country was found very productive throughout, and well worthy of extended commercial enterprises. As far as Rahang, the river was ascended by poling: the country on either side was low, flat, and fertile; numerous ruins were seen there. A variety of valuable timber is brought from the forests by elephants and oxen, and floated down the river to Bangkok. Other products are cotton, wax, resin, tobacco, hides, and horns. Above Rahang, rapids interrupt the up-stream navigation, and the journey was continued overland on elephants. Lakon is the centre of the elephant trade: Bock found a thousand of these great animals there, where they are brought after capture in the forest; their value varies from five hundred to two thousand rupees. Oxen are sold at sixteen to twenty-five rupees. Tchengmai, at an elevation of seven hundred feet on the Meping (the upper course of the Menang, above the rapids) is an important and busy city, with a population estimated at a hundred thousand. Teakwood and gum-lac are among its chief commodities. A railroad from the southern coast should be constructed as far as this point, as, in addition to what now goes down the river, it would gain a large share of what is carried northward to Yunnan, and out to Canton. From Tchengmai, Bock turned a little north-east, and crossed a pass of twelve hundred feet elevation into the valley of the Mekok, that flows on to the Mekong at an altitude of eight hundred and seventy feet. The latter is a large river in a superb valley, lined with valuable forests; its lower course should be examined to learn if timber could not be floated down to the sea. Bock was unable to do this, and returned to Tchengmai, whence he descended the Meping, running the rapids into the open lower valley. — (*Peterm. mitth.*, 1883, 161.) W. M. D. [1163

BOTANY.

Relative size of diclinous flowers. — Fritz Müller mentions Carica papaya — which is something of a curiosity in having polypetalous pistillate flowers and gamopetalous staminate flowers, which have been divided into two so-called genera — as forming an exception to Sprengel's rule, that, in entomophilous plants with imperfect flowers, the male are more conspicuous than the female; that they may be first visited by insects, which carry their pollen to the pistils. The greater size of the pistillate flowers in this species is explained by their concealed position among the leaves, while the smaller staminate flowers hang out in conspicuous clusters. In this connection it is shown by Hermann Müller that in monoecious species, which attract a sufficiency of insect visitors, it may be an advantage for the fertile flowers to be the larger, as those of a given stock will then be visited first, and fertilized by foreign pollen, before the insects have been to the sterile flowers of the plant in question. On the other hand, in cases where crossing is uncertain, the larger size of the staminate flowers will insure at least close fertilization, and thus be advantageous. — (*Kosmos*, April.) W. T. [1164

The purple-leaved barberry. — Mr. Thomas Meehan referred to the fact that seed of the purple-leaved variety of Berberis vulgaris, collected from plants growing near Philadelphia, reproduced the purple-leaved peculiarity to an extent which it could not do more perfectly if the variety were a true species. In a bed of seedlings containing on an estimate one thousand plants, there were only two reversions to the original green-leaved condition. — (*Acad. nat. sc. Philad. meeting*; May 15.) [1165

Influence of stock and scion. — According to the *Tropical agriculturist*, Mr. Moen has obtained some extraordinary and undesirable results from grafting scions of Cinchona Ledgeriana upon stocks of Red bark. The grafts have been cultivated under glass, and are now four years old. Examination has shown that the bark of the stock is rendered abnormally rich in quinine 'by its contact with the graft;' but the bark of the graft itself is found to contain less quinine than it should, while it has more cinchonine and cinchonidine. Since the amount of the bark of the stock is, of course, very small when compared with that of the vigorously-growing scion which must ultimately form the bulk of the whole, nothing is gained by the grafting. It diminishes, rather, the value of the plant. It is now proposed to try the reverse experiment. It is very probable that subsequent experiments may show that part, at least, of the un-

favorable results may be explained by the fact that only young plants have been studied. — (*Gard. chronicle*, May 26.) G. L. G. [1166

ZOÖLOGY.

(*General physiology and embryology.*)

Spermatogenesis. — J. E. Bloomfield gives a *résumé* of the recent papers by Duval, Hermann, Renson, Sabatier, and von Brunn on this subject, and points out that they confirm the old idea that the spermatozoa are developed in mother-cells, a part of which remains behind. (The general hypothetical bearing of this fact was first brought forward by Minot. Bloomfield, in an article on spermatogenesis, advanced this view again, and apparently still regards it as original with himself.) — (*Quart. journ. micr. sc.*, 1883, 320.) C. S. M. [1167

The coloring-matters of the bile of invertebrates. — C. A. MacMunn communicates to the Royal society the results of a systematic examination of the bile and various extracts of the liver of mollusca and other invertebrates. The universal distribution is proved of a chlorophyll pigment, to which the name of 'enterochlorophyll' is applied. It can be found in the bile of specimens of Helix after a six-months fast, and is much more abundant in the liver of mollusca and echinoderms than in crustacea. The presence of reduced haematin is also demonstrated in the bile of several pulmonate mollusks. The bile of the cray-fish and most pulmonate mollusks contains haemochromogen, generally accompanied by enterochlorophyll, and appears in the latter group to be more concerned in aerial than aquatic respiration. He concludes that the so-called liver of invertebrates is a pigment producing and storing organ in addition to its functions connected with the production of digestive ferments. The presence of haemochomogen is apparently connected rather with the mode of life of the invertebrates in which it occurs than distributed according to morphological considerations. A drawing of the microscopical structure of the liver of Limax, showing the enterochlorophyll within the liver-cells, and maps of the most important absorption spectra, described with readings reduced to wave-lengths, accompany the paper. — (*Nature*, May 10.) W. H. D. [1168

Protozoa.

Polemical about protozoa. — In reply to the criticism of Bütschli (ante, **273**) concerning the view maintained by Balbiani in regard to the conjugation of Infusoria, the latter points out that he accepts and has in part confirmed Bütschli's observations, but differs from him as to the conclusions to be drawn from them. From Balbiani's own statement, however, it appears that he has entirely changed his former theories, and essentially adopted Bütschli's; and in stating that his old views could still be essentially preserved he seems not ingenuous. — (*Zool. anz.*, vi. 192.)

Künstler also replies to Bütschli's assertion (ante, **269**) that Künckelia gyrans is a Cercaria: it has no ventral sucker, it swims with the tail forward, and shows no trace of cellular organization. K., however, now admits that it is probably a metazoon larva, and not related to the Flagellata. — (*Zool anz.*, vi. 168.) C. S. M. [1169

Dimorphism of Foraminifera. — It is stated by Munier-Chalmas and Schlumberger that in many genera of Miliolidae there are two forms of the species. Although the individuals are often alike externally, they may be divided into two sets, according to the arrangement of the central chambers. Thus in Biloculina depressa, in form *A* the central round chamber is large, and the other chambers next it follow the bilocular arrangement; in form *B*, the central round chamber is very small, and those next it present the quinqueloculor order, which, however, is soon suddenly replaced by the usual bilocular arrangement. This dimorphism is probably general in the group. The authors' first note on this subject is contained in the *Bull. soc. géol. France* (3), viii. 300; their second, in the *Comptes rendus*, March 26, 1883. — (*Ann. mag. nat. hist.*, ii. 336.) C. S. M. [1170

Coelenterates.

Phylogeny of the Siphonophorae. — Fewkes points out the resemblance between the *primitive scale* of Agalma and the *nectocalyx* of Monophyes, as well as the close resemblance of the embryonic knobs of Agalma and Halistemma to the tentacular knobs of the Calycophores.

He believes that these resemblances are an indication of the point in the development of the Siphonophora where the separation of the Physophorae from the Calycophorae, or the separation of both groups from a *stem form*, took place. — (*Amer. nat.*, June.) W. K. B. [1171

New Brazilian medusa. — In his work on the deep-sea Medusae collected by the Challenger expedition, Haeckel describes an interesting genus, Drymoneura, represented by a single species from Gibraltar. Fr. Müller records the occurrence of a second species, Drymoneura Gorge, which he has found in 1857, 1860, and 1861, on the coast of Brazil. The Brazilian form was found in a very shallow inlet, and the genus cannot be regarded as a deep-sea form. — (*Zool. anz.*, no. 137.) W. K. B. [1172

Insects.

Odonata of the Philippines. — Baron de Sélys gives a list of seventy-seven species, with descriptions of new species, and notes on those previously known. Twenty years ago hardly one was known from the region. The present paper is due to the collections of Semper; and, with the exception of Hypocnemus, which is figured, all the genera and even sub-genera are represented in other oriental countries. But forty-one of the species are peculiar to the Philippines. A single species of the otherwise wholly African genus Libellago occurs. — (*Anal. soc. esp. hist. nat.*, xi.) [1173

Scolopendrella. — In a new species described and figured from Massachusetts, peculiar for the robustness of the legs, Scudder finds the openings considered by Ryder as stigmata next the bases of the legs, but believes he has also found stigmata in the head, as in some Thysanura. He also compares the conical protrusion of the mouth-parts to those of Podura. — (*Proc. Bost. soc. nat. hist.*, xxii. 64.) [1174

Growth of the ova in Chironomus. — Jaworowski advances some singular notions on this subject. The eggs grow directly from the blood, not at the expense of other cells, or by the intermediation of the follicular epithelium. In pupal life the amount of the blood is reduced to a minimum; when the eggs are discharged by the imago, they leave a large space; the blood flows in and partly fills it, so that there is less blood left in circulation than can sustain life; hence the insect dies. (It does not appear that the author's startling assertions rest upon any observed facts.) — (*Zool. anz*, vi. 211.) C. S. M. [1175

VERTEBRATES.

Development of the pulmonary epithelium. — The lungs of the human adult have been minutely studied by Kölliker, whose memoir, which appeared in 1881, still left the development of the lung to be worked out. This gap has now been partially filled by Nicolai Jalan de la Croix, who, however, has relied on the chick and mammalian embryos for the earliest stages. In a human embryo of the third month (6.5 cm.) the bronchi are nearly straight tubes branching at acute angles; the alveoli have begun to form at their ends, but are developed in the inner part of the lung only later; the connective tissue is in process of differentiation; the whole system of respiratory cavities is lined by a continuous epithelium, which is thickest in the trachea, where it has several layers of cells, and which gradually thins out, until, in the alveoli, it consists only of two layers of cells, the deeper cells being somewhat smaller, the upper ones irregular in shape, and approaching the cylindrical form. The alveoli are already grouped into lobules; and it is these which Kölliker has described in his embryology as the primitive alveoli. By the end of the fourth month the bronchi branch off at much greater angles; the epithelium in the terminal vesicles is only 15 μ thick, and consists of a single row of cylinder cells. In the fifth month the connective tissue around the bronchi is quite advanced in development; it is, between the lobules, largely fibrous; between the alveoli, still rich in cells. The alveoli themselves measure about 0.05 mm. in diameter; their epithelium, only 11 μ in thickness. The blood-vessels have attained an enormous development, but are not yet close to the respiratory surfaces. Comparison of the different stages shows that the alveoli gradually increase in number, and at the same time diminish in size (author's *résumé, vide* p. 109). The conversion of the many-layered original epithelium into the single layer of the alveoli, the author asserts (apparently without definite reason) to be effected by the passage of the deeper-lying cells into the upper layer. By this process, as well as by the multiplication of the cells, is the rapid expansion of the epithelium to be explained. For the history during the fifth to ninth month, de la Croix collates the previous literature.

In the mature foetus (still-born) alveoli are still forming along the alveolar canals. The epithelium of the canals and all alveoli is still cylindrical, the cells with oval nucleus being about twice as high as broad. The alveoli do not yet extend down into the meshes of the capillary net-work. In a child that lived for seven days the flattening-out of the alveolar epithelium had already made considerable progress (Stieda found that this flattening took place much earlier in sheep embryos). The very rapid development of the pavement out of the cylinder epithelium, the author says, must be necessarily produced by the expansion of the lungs after birth. (There are two objections to this view, — first, it is not shown that the change accompanies an expansion; second, it fails to account for the development of the flat cells during foetal life, as in sheep. *Rep.*) — (*Arch. mikr. anat.*, xxii. 93.) C. S. M. [1176

The nature of inhibition. — Professor T. Lauder Brunton has lately offered a theory of inhibition founded on its analogy to the interference which occurs when waves of light or sound meet in opposite phases. According to his hypothesis, there are, in the cord and brain, successive layers of sensory and motor cells, so arranged that each motor cell is connected, not only with its corresponding sensory cell, through which the afferent impulse causing a simple reflex first passes, but also with other sensory cells higher or lower in the cord. When the afferent nerve leading to a sensory cell is slightly stimulated, a simple reflex occurs through the corresponding motor cell. So when several afferent fibres are gently stimulated, as in tickling the sole of the foot, the impulse from each sensory cell passes to a motor cell, and calls forth a reflex contraction. If the afferent fibre leading to any sensory cell is more strongly stimulated, the impulse on reaching the sensory cell will divide, part going directly to the motor cell, part passing to a neighboring sensory cell and thence indirectly to the motor cell. The consequence is, that the two waves of impulse, having travelled paths of unequal length, meet in opposite phases, and an interference or inhibition results. A firm pressure applied to the sole of the foot arouses no reflex contraction. No place is given in the theory to special inhibitory cells. Any cell may exercise an inhibitory action on the sensory or motor cells with which it is connected. Whether its action on any other cell shall augment or inhibit the activity of the latter, depends on the phase in which the wave of impulse travelling from it meets the wave of impulse that has reached the same cell from another source. In the case of inhibition by the will, the impulse sent down from the brain is supposed to interfere with that originating in the cord from the stimulation of sensory nerves. Besides inhibition by interference, apparent inhibition by the diversion of the stimulus into other than its customary path may occur.

Brunton attempts to explain many of the well-known phenomena of inhibition on this hypothesis. His explanation of the action of drugs — such as atropia, morphia, strychnia — on the theory of interference is particularly weak and unsatisfactory. — (*Nature*, nos. 696–699.) W. H. H. [1177

Man.

Electrotonus of the motor nerves of man. — Since the discovery by Pflüger of the general laws of electrotonic changes in a nerve during the passage of a galvanic current, from investigations made upon the dissected nerves of frogs, numerous attempts have been made to verify his conclusions for the uninjured nerve of man. The general outcome of this work has not been satisfactory, as far as a confirmation of Pflüger's generalizations is concerned. Perhaps the chief cause of the discrepancy amongst the results of different observers has been the neglect to fully appreciate the fact pointed out by Helmholtz, that when the uninjured nerve, in its natural position in the body, is exposed to an electrical current, there exist in the region of each electrode, owing to rapid current diffusion, areas of different electrical density, which must, therefore, be considered as electrodes of opposite signs. Waller and de Watteville have investigated the subject anew upon the motor nerves of man, and obtained results which are in accord with the laws established by Pflüger. Their experiments were made in most cases upon the peroneal nerve, and the contractions of the corresponding muscles were registered by appropriate means upon a smoked drum. They employed three methods of stimulation, — induction currents, constant currents, and mechanical stimuli. The unipolar method was used in all cases, and the polarizing and stimulating currents were combined in one circuit. By this means the points of stimulation and polarization were made co-extensive, and the electrotonic changes in the polar region obtained. In mechanical excitation the same result was reached by using the polarizing electrode itself to give the stimulating blow. The authors have

adopted the theory of a 'mixed polar action for both polarizing and testing currents;' that is, at the electrode applied to the nerve, there exist for each current, stimulating as well as polarizing, a 'polar' region of the same sign as the electrode, and a 'peripolar' region of the opposite sign, the electrical density of the latter being less than that of the former, but still sufficient to act as a physiological stimulus. When an induction current was used to test the 'polar alteration of excitability' produced by the polarizing current, the results were found to differ according as the 'exploring' electrode represented the kathode or anode of both currents, or the kathode of one and the anode of the other. In the first case the effect of the induction shocks are increased; in the second case, diminished. They explain their results in this way. When the electrode is kathode of the induction current, the excitation proceeds from the kathodic polar region. If the electrode is at the same time the kathode of the polarizing current, the polar region is kathodic, and possesses increased irritability. If the electrode is anode of the polarizing current, the polar region is anodic, and its irritability is diminished. When, on the other hand, the electrode is anode of the induction current, the excitation proceeds from the peripolar kathodic region, since all contractions with induction currents are make-contractions. If the electrode is at the same time the anode of the polarizing current, the peripolar region is kathodic, and therefore of increased excitability. If the electrode is kathode of the polarizing current, the peripolar region is anodic, and therefore of diminished excitability. When the testing current is a galvanic current, and both polarizing and testing currents are in the same direction, it is found that the effect of the kathodic make is increased during the flow of a kathodic current, and of an anodic make during the flow of an anodic current. The excitation proceeds from a kathodic region of increased irritability, in one case polar, in the other peripolar. So the effect of a kathodic break is diminished during the flow of a kathodic current, and of an anodic break during the flow of an anodic current. The excitation arises from the disappearance of an electrotonus in an anelectrotonic region of depressed irritability, in one case peripolar, in the other polar. With regard to mechanical stimulation, it was observed that the effect is increased when the polar region is kathodic, and diminished when it is anodic. They made some experiments upon the after-effects of the polarizing current, the results of which show that there is an after-kathodic diminution and an after-anodic increase of excitability, which are more marked in the polar than in the peripolar region. — (*Phil. trans.*, 1882, 961.) W. H. H. [1178

Electrotonus of the sensory nerves of man. — Waller and de Watteville have carried out a series of experiments on the alterations of excitability of the sensory nerves during the passage of a galvanic current, similar to those made upon the motor nerves. Their method of work was essentially the same as in the preceding investigation. In order to measure the increase or diminution of sensation after polarization, they ascertained the least strength of current which would produce a 'reaction in consciousness,' and then noted the changes necessary to be made after polarization to obtain the same effect. Their general result is, that, "after the passage of a galvanic current, the alterations in the excitability of the sensory nerves of man follow a course essentially similar to that observed in the motor nerves." — (*Proc. roy. soc.*, 1882, 222.) W. H. H. [1179

ANTHROPOLOGY.

Smithsonian anthropological papers. — The great delay in bringing out the annual report for 1881 has induced Prof. Baird to publish the scientific summaries and the anthropological papers in separate pamphlets. The summary, as usual, is by Prof. Mason, and the papers were all prepared under his editorial care. The summary is divided into two parts, the discussion and the bibliography. In order to show just where each contribution for the year stands with reference to the whole, he divides anthropology into eleven parts, — anthropogeny, archeology, biology of man, psychology, glossology, ethnology, technology, sociology, mythology, hexiology, and bibliography; the latter term including all aids to the study of man. By the use of the Greek words γράφη, λόγος, νόμος, and γενεά, the suffixes -ography, -ology, -onomy, and -ogeny, may be applied to each of the foregoing terms, in order to indicate the observing, the classifying, the discursive, and the philosophic phases of each branch of inquiry. Separate chapters are devoted to each of the leading topics.

The miscellaneous papers are unusually numerous. Explorations of mounds in Kansas are reported by Mr. Serviss; in Iowa, by Banta and Garretson; in Missouri, by Hardy, Scheetz, and Watkins; in Wisconsin and Illinois, by Moody, Shallenberger, and Adams; in Ohio, by Luther; in Kentucky, by Linney and Evans; in Tennessee, by Haite; in Alabama, by Gesner; in Georgia, by Whittlesey; in Florida, by Bell. Other aboriginal works are treated by Whitcomb for Washington Territory, by Stinson for Indiana, and by Case and MacLean for Ohio. Miscellaneous antiquities are reported from Iowa by Dean; from Illinois, by Gale, McClelland, French, Farrell, and Sibley; in Texas, by Roessler; in Arkansas, by Jones; in Pennsylvania, by Hayden; in New York, by Sheward; in Connecticut, by Ellsworth; and in Nova Scotia, by Patterson. Besides these are papers on shell-heaps in Alabama, West Virginia, and Massachusetts, by Mohr, Hubbard, and Wing; on inscriptions in Arkansas, by Green; on buried flints in Illinois, by Snyder: on silver crosses from a Georgia mound, by Jones; on ancient canals in Florida, by Kenworthy; on rock-carvings on the Susquehanna, by Galbraith; on a sculptured stone from New Brunswick, by Jack; on a perforated tablet from New York, by Tooker; a specimen of aboriginal art, by Matthew; and on the aborigines of Florida, by Walker. — J. W. P. [1180

Egyptian boomerangs. — Gen. Pitt-Rivers takes the occasion of receiving an Egyptian boomerang as a text for the review of the subject of the spread of that interesting weapon. His description is accompanied by a plate, giving figures of twelve boomerangs from the same quarter, which he had seen in different museums. There are four phases in the evolution of the boomerang worthy of notice. 1. All weapons which are thrown by the hand, and which are not specially adapted for rotation. 2. A round, curved stick, which would rotate more freely than a straight one. 3. The same weapon made from a split stick, opposing to the atmosphere a thinner edge, whereby the rotation and range would be greatly increased. This is the most important stage in the development of the boomerang. In this state it was used by the Australians for purposes of war, after they had further acquired a knowledge of the returning or screw boomerang. It was in this stage that Gen. Pitt-Rivers supposes it was carried by the black races into those distant regions where it is now used. 4. Those weapons to which is imparted by

peculiar twists a screw movement tending upwards, or at any rate in a direction that is perpendicular to the plane of rotation. This last stage of improvement, so far as we at present know, was effected in Australia only, and not in those countries into which, in its simpler form, it had been previously distributed by the migration of tribes. The Egyptian, African, and Dravidian boomerangs may not have been independent inventions, therefore. The boomerang being a weapon of very primitive construction, and its present distribution being coincident with the distribution of some of the black races of man, it may with great probability be regarded as one of those weapons which primeval men carried with them into distant parts from the home of their ancestors, wherever it was. In speaking of the distribution of this weapon, writers should be careful to note that the Egyptian boomerang, the trombush of the blacks of Abyssinia, and that of the blacks of Hindostan, correspond only to one class of the Australian boomerang, — viz., that used by them for war, and considered to be the most useful weapon they employ, — and that this differs from the returning boomerang, which has a lateral twist by means of which it is caused to rise in the air, screwing itself up precisely in the same manner as a boy's flying-top, which rises and spins against the ceiling. — (*Journ. anthrop. inst.*, xii. 454.) J. W. P. [1181

Hittite inscriptions. — So many attempts to decipher the Maya hieroglyphs have been based upon the processes that have led to brilliant results in Egyptian and Mesopotamian inscriptions, that we are not surprised to find an author deciphering Hittite by means of Aztec phonetic values. Prof. John Campbell of Montreal has in press a volume on the history of the Hittites, their migrations, antiquities, and language, in which will appear translations of some of the inscriptions first discovered by Mr. Drake in 1871. A pamphlet of sixteen pages, however, precedes the volume, giving the translations. Briefly, the author believes that the Hittite empire, overthrown in 717 B.C., was re-established successively in India, north of the Altai, north-east of China, in Khitan, Mantchuria, Saghalin, Corea, and Japan, and finally as Aztec, Peruvian, and Chibcha, on the American continent. Mr. Campbell, therefore, has only to give to the characters of Hamath resembling those of Mexico their Aztec phonetic values, and the thing is done. — J. W. P. [1182

EGYPTOLOGY.

Geography. — The vast field of ancient geography yet to be explored is indicated by the fact that two thousand names of places outside of Egypt, mentioned in the geographical lists, still await identification. Brugsch points out some necessary cautions. 1°. The different systems of orientation. The Egyptian always imagined himself as standing face to the south : the east was on the left hand, the west on the right hand, and the north behind him. The African made a point, between the Nile and the Red Sea, east of Ethiopia, the place from which he judged of the relations of countries : hence to him Ethiopia was in the west, etc. The Asiatic faced the east, and spoke of it as before him, the west as behind him. And the Egyptian monuments represent, sometimes one, sometimes another, of the systems in giving the relations of the same place. 2°. The Egyptians very frequently translated and did not transcribe foreign names. It has often been remarked that the names of nations well known in pre-classic antiquity, and with whom the Egyptians were well acquainted, are not found on the monuments. These names must be sought in the Egyptian translations. 3°. The Egyptian geographical lists, in their enumeration of African peoples, proceed from south to north : among Asiatic nations they proceed from north to south; i.e., in both cases they follow the downward course of the great rivers.

Brugsch believes that Punt was a southern land, not in Arabia (where most place it), but in Africa, and that the Egyptians sent expeditions thither at a very early period in their history. Hommel (*Vorsemitischen kulturen*, 1883, p. 108, 421) thinks these expeditions began about 2450 B.C. — (*Revue egyptol.*, iv.) H. O. [1183

NOTES AND NEWS.

The remains of the late Professor Charles Frederic Hartt, who is well remembered for his extensive scientific researches in Brazil, arrived at New York from Rio de Janeiro on June 7 last, by the steamer Finance. They will be carried to Buffalo, N.Y., the home of Mrs. Hartt, for interment. Over five years have now elapsed since the death of this distinguished naturalist and linguist, whose life was so faithfully dedicated to the cause of Brazilian science. Completely worn out by the drudgery of official cares in trying to perfect the organization of which he was the chief, against the jealousies of a foreign and unappreciative people, he fell an easy victim to that most dreaded of all Brazilian scourges, yellow-fever, which afflicted so many Americans during the early spring of 1878. His grave in the protestant section of one of the larger Rio cemeteries has borne no other mark than the customary number by which it could be identified. While Brazil has neglected the memory of one who more than any other gave character and purity of purpose to its scientific undertakings, his own country will not fail to do him homage.

— The Report of the chief of ordnance, U.S.A., 1882, contains some important matter relating to the science and practice of gunnery. Col. Crispin makes a long and valuable report on European ordnance. The methods of construction of British and French ordnance are described, and the advantages of malleable over cast irons are exhibited. The now familiar effects of tempering in oil, as practised in British gun-making establishments, are described. Soft steels having a tenacity, untempered, of thirty-one tons per square inch are given a strength of forty-seven tons by oil-tempering, their elongation being, meantime, reduced somewhat by the process. The reporting officer concludes that the direction of change is toward the introduction of built-up forged guns, or built guns of cast steel, and that the future is to see the introduction of this principle carried to its limit in guns made of coiled wire, as proposed by Treadwell of Cambridge, and recently by Woodbridge, — a conclusion manifestly at variance with the results described in his report as attained by Whitworth with solid guns of compressed steel. The principles upon which Whitworth is working

are summed up by that inventor as "strong, ductile, and sound materials, strong, quick-burning powder, short guns, long projectiles, and rapid rotation." Lieut. Birnie's conversion-tables for metric measures are included in this volume. They are substantially the same as those issued by the Messrs. Wiley, together with Noble's British tables, and other matter from Thurston's Materials of engineering. Capts. Michaelis and Greer discuss the deviations of projectiles mathematically. The report is supplied to libraries and scientific departments by the chief of ordnance.

— De Candolle's 'Origine des plantes cultivées' has received a searching review at the hands of Professor Asa Gray and Mr. J. Hammond Trumbull in the *American journal of science.* The book itself is as valuable to anthropology as it is to botany, and it was fitting that a competent representative of each of these sciences should be associated in its examination. The reviewers, however, in this case, seem to have had a definite object ulterior to that of merely appreciating this last great contribution of the venerable phytologist. The claims of America as the original source of a large number of the best-known vegetable products of the globe required to be defended; and they deliberately assumed and performed this task, showing in a large number of cases that De Candolle had either ignored or had not duly weighed the evidence that exists in favor of their American origin. The comprehensive and critical learning displayed in these articles, relative to the mention of these plants in the early history of American discovery, is only equalled by the shrewdness and force with which it is marshalled in support of the views which the writers feel called upon to set forth and sustain.

— 'Progress in meteorology, 1879–81.' This useful contribution to the English literature of meteorology has been published by the Smithsonian institution under the editorship of Professor Cleveland Abbe of the army signal-office. It consists, as the author expressly states, of extracts, mostly from the Vienna *Zeitschrift* for the years 1879, 1880, and 1881; and this accounts for the notices from the German of two papers originally published in this country. Biographical notices of eminent meteorologists who died in the interval covered by this pamphlet, a concise description of the work contemplated by the Polar commission, and an account of the meteorological work in hand and proposed by nearly all the different governments, are given. Under well-arranged heads, such as bibliography, methods, apparatus, etc., chemical and physical properties of the atmosphere, solar radiation and terrestrial temperature, movements of the atmosphere, barometric pressure, electricity, magnetism, and optical phenomena, will be found abundant material for study, and of the later scientific investigations in the protean subject of meteorology.

— The Worcester county, Mass., free school of industrial science is now completing its fifteenth year. It offers free instruction to students, who, at the time they enter, are residents of the county. There is a further endowment by the state for twenty free scholarships for students elected by the board of education. The school is by no means a local institution, a large number of the boys coming from outside Massachusetts. At present there is great need of an increase in the accommodations of the chemical and engineering departments. The friends of the institution are bestirring themselves, and have issued a pamphlet stating the results of the school's work up to this time, and the urgent need there is for further room, that the growth of the institution may not be cramped. The mechanical department, possibly the most thriving, has received, within the last two or three years, greatly increased facilities, but is pressed to the utmost to fulfil the demands upon it.

— At the meeting of the Engineers' club of Philadelphia, May 19, Mr. C. G. Darrach exhibited two profiles from Tiffin, O., to Lake Station, on the southern bend of Lake Michigan. The surveys were made for the Baltimore and Ohio short line to Chicago, — one *viâ* Napoleon, and the other *viâ* Defiance, O. About 240 miles of surveys were run, and the profile and maps plotted in sixty working-days, with a party of eight men.

At the meeting of June 2, Mr. Carl Hering read a short article on electrical units and formulae; Prof. L. M. Haupt exhibited a drawing of the Phoenixville bridge, which was built by Mr. Moncure Robinson, C.E., in 1836, for the Philadelphia and Reading Railroad, over the Schuylkill. It is an instructive and enduring monument of successful construction of cut-stone masonry. There are four segmental arches 72 feet clear span, and 16¼ feet rise; radius of arch, 47¼ feet; voussoirs, 2 feet 9 inches thick. One end abuts against a rocky bluff, whilst the other is supported by a heavy abutment with an earthen filling. It is believed to be one of the lightest and cheapest bridges of its kind in this country, having cost but $48,000. The secretary exhibited samples of Japanese paper, which he had obtained through Mr. J. A. L. Waddell. Many Japanese papers are of excellent quality, and could probably be used with great advantage in engineering practice.

— Van Nostrand has published, as one of the excellent 'Science series,' a book of logarithms to four places, of logarithmic and natural functions. The tables seem to be very well arranged, especially those of the natural functions.

— Dr. Ralph Copeland, editor of *Copernicus*, writes to that journal in the latter part of February last from La Paz, Bolivia, 12,050 feet above the level of the sea, —

"For the first time for ten days, the sky is tolerably clear, and remarkably dark, although the moon is al-

most exactly full, and at an altitude of some 30°. At 9h. 30m. local mean time, to test the clearness of the air and the visibility of fifth and sixth magnitude stars, I made a naked-eye sketch of the Hyades and Pleiades, which were also roughly at the same altitude as the moon, but considerably more than 90° distant from her. In the Pleiades I distinctly made out ten stars, — D. M. + 24°, 553 and 556, both of 7.0 magnitude, being seen as one star; and D. M. + 24°, 546, of magnitude 6.3, being clearly visible. In the head of Taurus I made out seventeen stars, two of which — D. M. + 16°, 586, and + 16°, 605 (of 6.0 and 5.0 magnitude) — are not in Argelander's *Uranometria nova*. I also saw σ Tauri plainly double.

"As it is now near the close of the rainy season, I hope shortly to be in a position to report something of what can be done with a six-inch refractor at 14,360 feet above the sea-level. My station is at Vincocaya, between Arequipa and Puno. In the mean time I am endeavoring to obtain the height of the Ilimani."

— Dr. Ralph Copeland, editor of *Copernicus*, writes to that journal in the latter part of January last, from Lima, —

"At Chorillos, near this, are staying M. Barnaud, Lieut. de Vaisseau, and M. Favreau, Enseigne de Vaisseau, members of the French Venus expeditions to Chili. Chorillos is the landing-point of the cable from Valparaiso and Panama. The French astronomers, in conjunction with two colleagues now at Valparaiso, are determining the difference of longitude. They have two-inch transit instruments, with chronographs and chronometers; and the cable is led directly into the observatory. The instruments are similar at both stations, and the observers do not interchange stations; but the personal equation has been determined for wire-transits, and signals transmitted by Thomson's galvanometer. The strength of current is adjusted by a rheostat to a constant strength. A triangulation will connect Chorillos, Callao, and Lima, distant some six or seven miles from each other. The connection of Valparaiso with Buenos Aires on the one hand, and with Callao and Panama on the other, will complete the circuit of the greater part of South America; the chain from Greenwich to Buenos Aires, through Lisbon, Madeira, St. Vincent, Pernambuco, Bahia, Rio Janeiro, and Montevideo, having been finished by Lieut.-Commander Green, U.S.N., in 1879."

— The first *livraison* of *Les nouvelles conquêtes de la science*, par Louis Figuier, is devoted to a sketch of the application of electricity to lighting. Judging from the sample of explanation given in the introduction, where the glowing of a conductor is attributed to the accumulation of an electric fluid, it cannot be said that the book promises to give a straightforward statement of facts without embellishment. The illustrations are numerous and attractive. Very much of the same untrustworthy character is the first *livraison* of *Nouvelle histoire des voyages*, par Richard Cortambert. Both of these books are for sale by F. W. Christern, New York.

— Prof. C. S. Sargent has recently prepared a striking statement of the loss, actual and prospective, suffered from forest-fires, and of the necessity of stringent legislation for their prevention. Especially should this loss be brought to public attention in New England, where so much surface is adapted only to forest-growing, and whence a great share of our white pine must come in future years. These states already possess valuable forests of second-growth pine, now reaching a size when they can properly be thinned out, leaving the smaller trees for future need. But in Massachusetts alone, ten thousand acres of forest are on the average burned annually; about one-third of the fires beginning from locomotive sparks, and nearly all the rest from easily avoided carelessness. This burning not only destroys the standing trees; it makes investment of capital in growing forests hazardous, it checks the growth of a very desirable industry, and it destroys the capacity of the ground to continue a pine growth. When properly cut, a pine forest may be propagated indefinitely. When burned, there is a long succession of weeds and briers, mountain cherry, gray birch, willows or poplars, maples, and ash-trees, until a hard-wood growth is established. This maintains itself for a long time if left alone; but if the ground be then cleared by cutting, cultivated for many years, and then left free from plough and scythe, and guarded from pasturing and fire, the white pine will spring up spontaneously after its long absence. Fifty or one hundred years must pass before this desirable crop returns. In view of so long a delay, and of the considerable value that pine will soon command, it is well that special care should be given to protecting and preserving the second-growth forests now approaching maturity.

— The national congress of the French geographic societies will meet this year at Douai, seat of the Geographic union of the north of France, on Aug. 26, for a week's session. Excursions will be made to Calais and other points on the channel, and to Charleville, and across the Ardennes to Belgium. A geographic exhibition is proposed in connection with the meeting.

— M. de Lesseps recently stated to the French geographical society that the work on the Panama canal was going on in good condition. Excavation has been begun all along the line. Two American machines had just been received, capable of digging three to four thousand cubic metres a day. The work is in charge of the chief engineer '*des ponts et chaussées*,' sent out from France by the canal company some months ago. The Algerian canal, in which M. de Lesseps is interested in connection with M. Rondaire, now, he says, stands a good chance of

receiving government concessions, in spite of the adverse report made by the Academy of sciences last year.

— The Entomological society of London, the second of its name, held its fiftieth anniversary last month; and, in his presidential address upon the occasion, Mr. J. W. Dunning suggested that Professor Westwood of Oxford be made titular life-president of the society. "An original member, he has never failed us. During the crucial period of our childhood, he was the motive power, the life and soul, of the society. For fourteen consecutive years he was secretary, and for part of that time he was curator also. The council has seldom been complete without him, and during six years he was our president. Whilst he resided in or near London, he rarely missed one of our meetings. Even Oxford cannot keep him away from us; and there is not a single year, from first to last, that he has not been a contributor to our transactions." This proposal was carried by acclamation.

— The unusual competition for the last 'Walker prize' of the Boston society of natural history induces the society to offer the same subject for next year's competition; viz., 'Original unpublished investigations on the life-history of any animal or plant.' While the partial treatment of the subject is permitted, preference will be given, other things being equal, to memoirs which embrace the whole life-history of an animal or plant from the early embryological stages to the adult form.

The society also offers, through the generosity of a member, for next year, a special first prize of from $60 to $100, and a second prize of $50, on the follow-subject: "A study of the venation of the hind-wings of Coleoptera, with illustrations of all the families of Le Conte's and Horn's classification." Essays in competition for both prizes must be sent to the secretary of the society before April 1.

— Over four hundred members of the British association have already pledged themselves to attend the meeting at Montreal in August, 1884. It is believed that all the permanent officers of the organization will be present.

— We learn that a series of fifteen original letters of Alexander von Humboldt to his intimate friend Wegener, bearing the dates 1788–90, is for sale in Germany. They have been made use of for the biography of Humboldt by Bruhns; and extracts have been more than once published, — most recently, in the Berlin journal *Gegenwart*, nos. 30 and 32, of 1882, — but they have never appeared in full. Any institution or private person desiring to acquire them should apply to Dr. G. A. Saalfeld, Hobsminden, Germany.

— In the weekly summary ¶ 1075, line 20, instead of 'acid,' read 'pentachlor- and hexachlor-compounds.'

In the 'Weather in March,' p. 388, for 'Fallstown, Ind.,' read 'Fallstown, Md.'

RECENT BOOKS AND PAMPHLETS.

American apiculturist, The. A journal devoted to scientific and practical bee-keeping. Edited by S. M. Locke. Vol. i., nos. 1-2. Salem, Mass., *Locke*, May–June, 1883. 48 p. 8°.

Anderson, J. Scotland in pagan times: the iron age. The Rhind lectures in archaeology for 1881. Edinburgh, *Douglas*, 1883. 332 p. 8°.

Basset, J. Anthony. Latitude and longitude, and longitude and time, embracing a comprehensive discussion, with over one hundred illustrative questions and problems. Syracuse, N.Y., *Bardeen*, 1883. 50 p. 16°.

Blackburn, T. True and false issues between christianity and science. London, *Skeffington*, 1883. 12°.

Box, T. A practical treatise on the strength of materials, including their elasticity and resistance to impact. London, *Spons*, 1883. 530 p. 8°.

Briart, Alphonse. Principes élémentaires de paléontologie. Avec 227 figures. Mons. *Baudry*. 12°.

Buck, J. H. W. A graphic table for facilitating the computation of the weights of wrought iron and steel girders, etc., for Parliament and other estimates. London, *Lockwood*, 1883. Large sheet.

Cotterill (Bishop of Edinburgh). Does science aid faith in regard to creation. London, *Hodder*, 1883. 226 p. 8°.

Dessoliers, H. De l'habitation dans les pays chauds. Contribution à l'art de l'acclimatation. (Alger) *J. Baudry*. illustr. 8°.

Dresler, E. F. Flora von Löwenberg in Schleswig; nach dem natürlichen system bearbeitet. Löwenberg, *Köhler*, 1883. 162 p. 12°.

Eclectic complete geography, The. Cinc. and N.Y., *Van Antwerp, Bragg, & Co.*, 1883. (New two-book series.) 114 p., illustr. 4°.

Haeckel, Ernst. A visit to Ceylon. Translated by Clara Bell. Boston, *Cassino*, 1883. 8+337 p. 16°.

Hoffman, Carl. Botanischer bilder-atlas nach De Candolle's natürlichem pflanzensystem. 1 lief. Stuttgart, *Thienemann*, 1883. 8+6 p., 6 colored lith. 4°.

Klein, E. Elements of histology. London, *Cassell*, 1883. 364 p., 181 illustr. 12°.

Maynard, C. J. Manual of taxidermy; a complete guide in collecting and preserving birds and mammals. Boston, *Cassino*, 1883. 16+111 p., illustr. 16°.

Mohnike, O. Blicke auf das pflanzen- und thierleben in den niederländischen Malaienländern. Münster, *Aschendorff*, 1883. 4+694 p., illustr. 8°.

Philanthropist (*pseudon*). Physiological cruelty; or, fact and fancy. An inquiry into the vivisection question. London, *Finsley*, 1883. 8°.

Reis, P. Die periodische wiederkehr von wassernoth und wassermangel im zusammenhang mit den sonnenflecken, den nordlichtern und dem erdmagnetismus. Leipzig, *Quandt & Händel*, 1883. 8+124 p., illustr. 8°.

Remelé, A. Untersuchungen über die versteinerungsführenden diluvialgeschiebe des norddeutschen flachlandes mit besonderer berücksichtigung der Mark Brandenburg. 1 lief. Berlin, *Springer*, 1883. 152 p., illustr. 4°.

Roche, T. C. How to make photographs: a manual for amateurs. Edited by H. T. Anthony. New York, *Anthony*, 1883. 91 p. 12°.

Sherrerd, J. M. Iron analysis record; with a complete table of atomic weights, their elements and symbols, with the old and new system. Troy, *Young*, 1883 12°.

Souchon, Abel. Traité d'astronomie pratique, comprenant l'exposition du calcul des éphémérides astronomiques et nautiques. *Gauthier-Villars*. 8°.

Step, Edward. Plant-life: popular papers on the phenomena of botany. N.Y., *Holt*, 1883. 12+218 p., illustr. 16°.

Taber, G. L. The fisheries of the Adriatic, and the fish thereof. London, *Quaritch*, 1883. illustr. 8°.

Tayler, I. The alphabet: an account of the origin and development of letters. 2 vols. London, *Paul*, 1883. 752 p. 8°.

Thiersch, H. W. J., und **Thiersch**, A. Die physiognomie des mondes. Versuch eine deutung derselben im anschluss an die arbeiten von Mädler, Nasmyth und Carpenter. Augsburg, *Preyss*, 1883. 4+43 p., 4 lith. 4°.

INDEX TO VOLUME I.

**** Figures in black-faced type refer to the numbered paragraphs in the 'weekly summary;' those in ordinary type, to pages. Names of contributors are printed in small capitals.*

LIST OF ILLUSTRATIONS.

ERRATA.

Page 50, col. 2, line 31, for 'Paramarcium' read 'Paramecium.'
" 73, " 1, " 67, for 'photographic sun' read 'photographic gun.'
" 97, " 2, " 16, for 'elevation in Greenland' read 'elevation in the region of greatest cold (the west) in Greenland.'
" 116, " 2, " 35, for 'tennicollis' read 'tenuicollis.'
" 119, " 1, " 16, for '*Chilly*' read '*Cheilly*.'
" 149, " 1, " 54, for 'Rogiferidae' read 'Rangiferidae.'
" 149, " 1, " 54, for 'Copridae' read 'Capridae.'
" 151, " 1, " 42, for 'Reptiles' read 'Mammals.'
" 177, " 1, " 19, for 'Rurichnites' read 'Rusichnites.'
" 177, " 1, " 20, for 'Traena' read 'Fraena.'
" 192, " 1, lines 10, 11, the clause "the coal next the mouth not partaking of the motion of that farther in the hill" belongs to the preceding and not to the succeeding sentence.
Page 255, col. 1, line 2, for 'Mittag-Zeffler' read 'Mittag-Leffler.
" 287, " 1, " 67, for 'tortricid' read 'tineid.'
" 294, " 1, " 8, for 'dollars' read 'shillings.'
" 306, " 1, " 23, for 'Lamium' read 'Lanium.'
" 338, " 2, " 49, for 'Rumford' read 'Ranyard.'
" 388, " 1, " 1, for 'Ind.' read 'Md.'
" 536, " 2, " 6, for 'Lun City' read 'Sun City.'
" 542, " 2, " 63, for 'grypus' read 'gryphus.'
" 550, " 1, " 49, for 'acid' read 'pentachlor- and hexachlor-compounds.'
" 612, " 2, " 34, for 'Drymoneura Gorge' read 'Drymonema gorgo.'

On p. 191, the cut, which is printed bottom upward, should be reversed.

SCIENCE:

An Illustrated Journal. Published Weekly, at

CAMBRIDGE, MASS.,

U. S. A.,

BY MOSES KING.

A GREETING

TO THE EDUCATED PEOPLE OF ALL COUNTRIES.

In the Year of our Lord 1883

A COMPANY of scientific men, having in mind the necessity of establishing a journal which in due time would well represent the progress that science is making throughout the world, and particularly in the United States, began such a journal under the title of

"SCIENCE."

The Company is composed of wealthy and eminent scientific men, whose sole aim is to direct and support a journal which shall in every particular be satisfactory to any one at all interested in any department of science; and although the journal has its price for subscriptions and advertisements, and also has a publisher who is, *ex officio* and by nature, a most earnest seeker for income from both those sources, and also from sales of single copies, nevertheless the directors of the company, under whose auspices the journal was founded and is conducted, are wholly uninfluenced by any pecuniary considerations whatever.

The directors have made provision for the regularly prompt, invariably accurate, and thoroughly creditable appearance of the journal on every Friday throughout the year, regardless of the receipt of a single subscription or a particle of advertising.

They have, moreover, provided for a fair remuneration to every one who has any thing which the editors think worthy of publication in the journal. They intend that the scientific news shall appear in such shape, and in such language, that not merely the technical scientist, but every educated person, shall find in every issue an amount of reading-matter that will repay him to have all the successive issues of the journal come to his home, so that he and his family may constantly keep informed on what there is new transpiring and being discovered all over the world.

In addition to the strictly called scientific news, there will be an abundant amount of other scientific matter; such as reports of conventions, discussions of topics, suggestions for methods of working, reviews of books, descriptions of institutions, histories of organizations, sketches of new apparatus and methods, biographies of scientific men, and various other matters which might reasonably be expected to find permanent place in a scientific journal of the widest scope and the highest class.

Illustrations, including portraits, will be found to be numerous enough to make the journal attractive in appearance, and to aid in conveying the information intended by the contributors.

In the course of a single year the journal will contain fifteen hundred (1,500) pages of text. These will make about thirty pages a week of text, wholly apart from every form of advertising. They will make up into two handsome volumes of about seven hundred and fifty pages each; both being provided with full and carefully compiled indexes, and having appropriate titlepages.

For all this matter the subscription-price is only $5 in the United States and Canada, and $6 in any other country. If you are not a subscriber already, will you take the pains to look through the copy of "Science" sent you in this mail, and then think over the contents of this circular, and finally send your subscription without much delay, so that your name may appear in the handsome little volume which will be issued, containing the names, addresses, and occupations of all the subscribers, who, by reason of their early support to this journal, show their active interest in an undertaking which is destined to become recognized as a help to scientific progress throughout the civilized world.

"Science," although published in America, is in reality an international journal; its contributions and news, its subscriptions and advertisements, coming from all parts of the world.

"Science" is owned by The Science Company, whose directors are Daniel C. Gilman, President, president of the Johns Hopkins University; Alexander Graham Bell, Vice-President, inventor of the telephone; Gardiner G. Hubbard, Attorney and Capitalist; Othniel C. Marsh, president National Academy of Sciences; Samuel H. Scudder, president of the Boston Society of Natural History.

Very truly yours,

MOSES KING, PUBLISHER.

BELOIT COLLEGE FOR YOUNG MEN. Two Collegiate Courses. In the Academy, two Preparatory Courses and a Business Course. Instruction thorough. Expenses moderate. Fall term opens Sept. 5, 1883, winter term, Jan. 2, 1884. Address
A. L. CHAPIN, President, BELOIT, WIS.

ENGLISH AND CLASSICAL SCHOOL, WEST NEWTON, MASS.
Twenty-ninth year. Both sexes. Preparatory for college, scientific schools, business, and for general culture. N. T. ALLEN.

TUTOR IN MATHEMATICS AND PHYSICS OR IN PREPARATORY STUDIES. Refers to the Dean of Harvard College.
Address GEORGE W. EVANS,
4 EDGEWORTH ST., CHARLESTOWN, MASS.

SCIENTIFIC LIBRARY FOR SALE. Includes four volumes "Journal of the Chemical Society" of London, ten volumes of "Chemical News," ten volumes of "Repertoire de Chimie Pure et Appliqué," twelve volumes of "Journal of Anatomy and Physiology," London, "Percy Wedding Metallurgie," and other valuable books and periodicals. List on application.
D. FISHER,
112 HURON ST., MILWAUKEE, WIS.

LOGARITHMS AND CHEMICAL FACTORS.

BY CHARLES R. SANGER. Card. 30 cents.

These tables are used by students in quantitative analysis, who will find the tables of logarithms, chemical factors, etc., very conveniently arranged for consultation while engaged in carrying on their experiments.

MOSES KING, Publisher,
CAMBRIDGE, MASS.

THE NATION.

EIGHTEENTH YEAR.

Size recently enlarged to twenty-four pages, and PRICE REDUCED TO $3 PER YEAR.

Sample copies sent on request. Address the
PUBLISHER, 210 BROADWAY, NEW YORK.

DERBY ROLL-TOP DESKS.

Elegant and durable finish. Best desk in use for business or professional men. Cherry, walnut, oak, ash, and mahogany.

GEORGE H. DERBY & CO.,
55 CHARLESTOWN STREET . . BOSTON, MASS.

Illustrated Catalogue sent free to any one who mentions "Science."

QUEEN & CO., PHILADELPHIA,

Manufacturers and Importers of Scientific Instruments of every description. Optical, Mathematical, Philosophical, and Chemical.

OUR CATALOGUES

are published in parts, and will be mailed upon application, as follows:—

Part 1, Mathematical Instruments, 162 pages. Part 2, Optical Instruments, including Spectacles, Microscopes, etc. (54th edition, 1883, now ready), 188 pages. Part 2 (Supplement), Opera, Field, and Spy Glasses, 32 pages. Part 2 (Supplement), Second-hand and other Microscopes, 16 pages. Part 3, Magic Lanterns and Slides, 150 pages. Part 3 (Supplement), Apparatus and Diagrams for Luminous Projections, 3 pages. Part 4, Physical Instruments, 188 pages. Part 4 (Supplement), Chemical Apparatus, Balances, etc., 60 pages. Part 4 (Supplement), Second-hand Physical and Chemical Apparatus, 16 pages. Part 5, Meteorological Instruments, Hydrometers, etc., 120 pages.
JAMES W. QUEEN & CO., PHILADELPHIA.

TOOLS AND MATERIALS of all kinds for Experimenters and Amateurs. Illustrated catalogue free to any address.
GOODNOW & WIGHTMAN,
176 Washington Street, Boston, Mass.

BINDERS FOR "SCIENCE."

Subscribers wishing a good binder in which to bind temporarily the successive issues of "Science" can obtain one by sending one dollar ($1) to

MOSES KING, Publisher of "Science,"
CAMBRIDGE, MASS.

The price stated above includes cost of packing, postage, and shipping to any address in the United States or Canada.

THIRTY YEARS' EXPERIENCE.

D. P. ILSLEY & CO.,

THE LEADERS OF FASHIONS IN

LADIES', GENTLEMEN'S, AND CHILDREN'S

HATS AND FURS.

ILSLEY & Co. exhibit in the season of 1883 the largest and most valuable stock of Straw Hats ever exhibited in Boston for Ladies, Gentlemen, and Children. These Straw Hats range from the finest to the coarsest, from the lowest to the highest priced. They come from the best makers of Europe and America, and include every leading style of this year.

D. P. ILSLEY & CO.,

381 WASHINGTON STREET, BOSTON.

DIRECTLY OPPOSITE FRANKLIN STREET.

ORDERS BY MAIL ATTENDED TO.

WATERS'S FLESH-BRUSH.

THE brush is made of vegetable fibre, w[illegible] fibre upon one side, making a positive and [illegible] and practically a double instrument. The material is so [illegible], that, when in use, a firm looped fibre is brought in contact with the surface to be acted upon, instead of the ends of bristles, as in the old brush, giving it great detergent power. It assists in restoring to and preserving in health by quickening the surface circulation, relieving internal congestions, freeing the pores of the skin, and promoting their functional activity; in that way relieving the blood of much clogging, effete matter, that would otherwise oppress the circulation, and might injure the lungs and kidneys in passing from the body, possibly producing Bright's disease or consumption.

A proper daily use of this brush helps all the organs of the body towards a healthy activity. It will be sent free of expense to any address, *with full directions for use*, worth more to any one than the price of the brush, on receipt of three dollars. The brush without the animal fibre is sold for two dollars. Liberal terms to the trade on application to the proprietor.

G. F. WATERS,

8 BEACON STREET . . . . . BOSTON, MASS.

SCIENCE DIRECTORY
OF

Trustworthy firms dealing in or manufacturing apparatus, books, and other goods required by persons engaged in scientific and literary work.

The publisher has carefully made up this directory, and inserts the name of no firm that he has any reason to believe is not wholly trustworthy in every particular. Any subscriber or reader of "Science" who ever experiences any difficulty with one of these firms will greatly oblige the publisher by notifying him of the fact, so that the firm's name may immediately be taken from this Directory.

It may be taken for granted that any firm herein mentioned will promptly and carefully send all desired information — with catalogue and circulars, whenever issued — to any person who mentions this paper in opening the correspondence.

MOSES KING, Publisher of "Science,"

Albertypes and Lithographing.
FORBES COMPANY, 181 Devonshire St., Boston.

Amateur Photograph Outfits.
BLAIR TOUROGRAPH Co., 471-475 Tremont St., Boston.

Electrical Supplies and Test Instruments.
ELECTRICAL SUPPLY Co., 17 Dey St., New York.

Illustrations and Drawings.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

Photo-Engraving and Designing.
PHOTO-ENGRAVING Co., 67 Park Place, New York.

ALBERT CUYP RUSSELL,
7 Pemberton Square, Boston, Mass.

Engraver on Wood. References: American Steam Gauge Co., Boston Journal of Commerce.

ELLIOTT [illegible]OS., LONDON.

Electrical Test Instruments,

From stock or imported to order.

Voltmeters and Ammeters,

From stock or manufactured and imported to order.

THE ELECTRICAL SUPPLY CO.,

17 De[illegible]t, New York.

[illegible]STER.

In S[illegible]p, Russia and Turkey Bindings.

Get the Standard.

GET Webster—it has **118,000 words, 3000 Engravings**, and a **New Biographical Dictionary.**

THE Standard in Gov't Printing Office, **32,000** copies in Public Schools, sale **20 to 1** of any other series.

BEST aid to make a **Family** intelligent. **Best help for SCHOLARS, TEACHERS and SCHOOLS.**

It is the best practical English Dictionary extant.—*London Quarterly Review.*

"It has all along kept a leading place, and the new edition brings it fairly up to date."—*London Times, June*, 1882.

"It has come to be recognized as the most useful existing 'word-book' of the English language all over the world."—*N. Y. Tribune*, 1882.

☞ The Vocabulary contains 3,000 more words than are treated in any other American dictionary.

G. & C. MERRIAM & CO., Pub'rs, Springfield, Mass.

MEDICAL DEPARTMENT, UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA.

PROFESSORS.—Joseph Leidy, R. A. F. Penrose, Alfred Stillé, D. Hayes Agnew, William Pepper, William Goodell, James Tyson, H. C. Wood, Theo. G. Wormley, John Ashurst, jun., Harrison Allen, William F. Norris, George Strawbridge, Louis A. Duhring.

The 118th Annual Winter Session will commence Monday, Oct. 1, 1883, and continue six and a half months.

The Preliminary Course will begin the second Monday in September.

Graded curriculum; three Winter Sessions required; fourth year voluntary.

Practical Instruction in all Departments; Post-graduate Courses in Autumn, Winter, and Spring months.

For particulars see Catalogue, for which address

JAMES TYSON, M. D., SECRETARY,
P. O. Box 2838.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

Regular four-year courses in Civil, Mechanical, and Mining Engineering, Architecture, Chemistry, Physics, Natural History, etc. Students are also admitted to partial or special courses. School of Mechanic Arts for instruction in English, French, Drawing, Mathematics, and Shop-work. Next school-year begins Sept. 24, 1883. Entrance examinations Sept. 18 and 19, at 9 A. M.

WEBSTER WELLS, Secretary.
FRANCIS A. WALKER, President.

Johns Hopkins University,

BALTIMORE, MARYLAND.

Collegiate and University Courses.

Announcements for 1883-84 will be sent on application.

CUSHING ACADEMY,
Ashburnham, Mass.

A first-class College-Preparatory and English School for both sexes. Expenses, $150 to $225 a year. Ninth year begins Sept. 5. Send for a Catalogue.

JAMES E. VOSE, Principal.

LENOX ACADEMY.

HARLAN H. BALLARD will admit into his family a few boys. Highest references exchanged. Unusual advantages offered. Apply at once to HARLAN H. BALLARD, LENOX, BERKSHIRE CO., MASS.

DARTMOUTH SUMMER SCHOOL OF Science, Hanover, N. H. Practical courses in Astronomy, Chemistry, Physics. Five weeks, beginning July 10, 1883. Address, for circular,

Prof. C. F. EMERSON, Hanover, N. H.

SHORT-HAND WRITING
taught through the mail. Standard system, capable instruction, reduced terms.

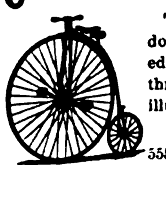
F. G. MORRIS,
Easthampton, Mass.

THE NEW BOTANY.

A lecture on the best method of teaching the science. By W. J. BEAL, M.Sc., Ph. D., Professor of Botany in Agricultural College, Lansing, Mich. Second edition. 8vo, paper. Mailed, postage free, for 25 cents. Send for circular and book list free. Address,

CHARLES H. MAROT, PUBLISHER,
814 Chestnut Street, Philadelphia.

COLUMBIA BICYCLES.



Thousands in daily use by doctors, lawyers, ministers, editors, merchants, etc. Send three-cent stamp for elegantly illustrated 36-page catalogue.

THE POPE M'F'G CO.,
555 Washington St., Boston.

PREPARATION FOR HARVARD,
BY PRIVATE TUITION,

Oxford and Cambridge (Eng.),
AND FOR

WELLESLEY, LADY MARGARET HALL, AND GIRTON COLLEGES FOR WOMEN.

BY E. R. HUMPHREYS, LL.D.,

Assisted by a Harvard Honor man in Mathematics.

The next yearly session will begin on October 2. Only eight pupils are admitted, of whom *three of either sex* may be received in the family.

Dr. Humphreys gives special attention to preparing earnest students to enter as Sophomores.

He and his assistant will remain in Boston *this vacation* to read with candidates for the FALL EXAMINATION.

For circulars and proofs of successful training of pupils, address

E. R. HUMPHREYS, LL.D.
129 W. Chester Park, Boston.
June 18, 1883.

MR. JOSHUA KENDALL'S
DAY AND FAMILY SCHOOL,
CAMBRIDGE, MASS.

for boys ten years old and upwards.

Special attention is given to fitting boys for college.

A few pupils can be taken into the family of the Principal.

For particulars inquire at the school-room, 13 Appian Way, or at 123 Inman Street, Cambridgeport, Mass.

PHILLIPS EXETER ACADEMY,
EXETER, N. H.

For information address

A. C. PERKINS, Principal.

MRS. S. L. CADY'S
Boarding and Day School for Young Ladies, New Haven, Conn. Fifteenth year commences Sept. 27. Send for circular.

THE MISSES ANABLE'S ENGLISH AND French Boarding and Day School for Young Ladies, 13 Livingston Avenue, New Brunswick, N. J. One hour from New York, and an hour and a half from Philadelphia, on the Pennsylvania Railroad. French under the care of a resident teacher from Paris. Music in charge of professors from New York. The school will open Sept. 12.

A USEFUL BOOK.

For the benefit of ladies who use knitting silk, the Nonotuck Silk Company have carefully prepared a book entitled "How to use Knitting-Silk." It is full of new engravings, and handsomely printed. Sent on receipt of three two-cent stamps.

NONOTUCK SILK CO., Florence, Mass.

PRIZES OFFERED
By the Boston Society of Natural History.

THE WALKER PRIZES, APRIL, 1884.

The Society offers a first prize of from $60 to $100, and a second prize of $50, for the best memoirs, in English, on the following subject:—

Original unpublished investigations on the life history of any animal or plant.

While the partial treatment of the subject is permitted, preference will be given, other things being equal, to memoirs which embrace the whole life history of an animal or plant, from the early embryological stages to the adult form.

SPECIAL PRIZE, APRIL, 1884.

The Society, through the generosity of a member, also offers a special first and second prize of the same amounts as the above, on the following subject:—

A study of the venation of the hind wings of Coleoptera, with illustrations of all the families of Le Conte's and Horn's classification.

The essays are to be sent to the Secretary of the Society on or before April 1, 1884, accompanied by a sealed envelope, endorsed with a motto corresponding to one on the essay, containing the name and address of the writer of the essay, which must not in any way be apparent in the manuscript.

EDWARD BURGESS, Secretary,
BOSTON, MASS

Contents of this Number.